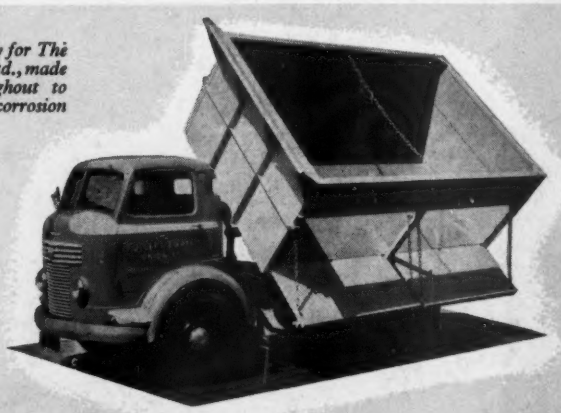
Annual Extra Number

# AUTOMOBILE ENGINEER

## LONDON SHOW REVIEW

Vol. 47 No. 12 27, NOVEMBER 1957 PRICE: 3s. 6d.


*Three-way tipping body for The Fullers' Earth Union Ltd., made of 'Duralumin' throughout to save weight, withstand corrosion and hard wear.*



*Payload increase of 30 cwt. was made possible by using 'Duralumin' for the body and cab of this bulk flour transport—one of six made for Joseph Rank Ltd., carrying special equipment for delivering flour to a height up to 100 ft.*

*This special side-loader on an Albion chassis has dropsides, roller shutters and bodywork of 'Duralumin'. It is divided into compartments specially designed to transport unstable pallet loads.*

**SAVE WEAR & TARE WITH**

**DURALUMIN**

JAMES BOOTH & COMPANY LIMITED

ARGYLE STREET WORKS · BIRMINGHAM · 7

TGA 187 134

# CHANGING GEAR 10,000 TIMES

In the B.B.A. Research and Development Laboratories this machine tests Mintex clutch liners. In a routine test, two clutches on a common shaft are engaged and disengaged automatically every twelve seconds no less than ten thousand times. During this time the clutch plate accelerates up to 1,200 r.p.m.

Tests such as these are everyday routine in the B.B.A. laboratories and are carried out on both production samples and on new and experimental liners. They form part of the continual programme of research and development on which the Mintex reputation is securely based.

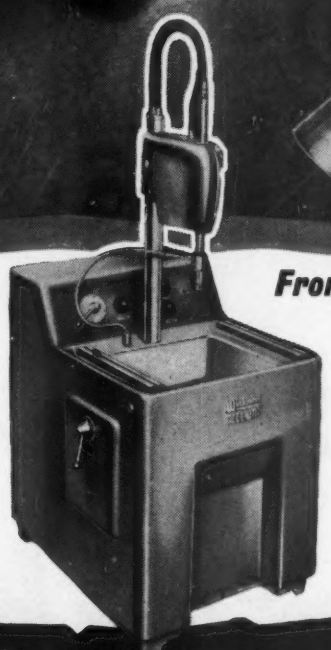
*you can rely on*

**MINTEX**

**Mintex Brake and Clutch Liners** are manufactured by British Belting & Asbestos Limited, Cleckheaton, Yorkshire, and are available from MINTEX Service Depots and Distributors throughout the country.

# Accurate die-sinking without costly toolmaking

From SPARK Machining



One of the features of spark-machining which is of particular appeal to the metal forming industries is the reduction in toolmaking which the method achieves.

Because die-forms can be produced from copper, brass or aluminium electrodes, which themselves may be the products of similar dies, toolmaking is reduced to the operation of mounting these on suitable adaptors for application to the machine.

A typical example is illustrated. It is a die for the production of gas tap bodies with one of the electrodes which produced it, made from a forging from a similar die.

This is one of the many ways that spark-machining is contributing to lower cost die-making and reservicing.

May we tell you more about this and its many other advantages?

*Visit* the demonstration of WICKMAN Equipment at THE ENGINEERING CENTRE STEPHENSON PLACE BIRMINGHAM 2. *From November 25th to 29th inc*

**WICKMAN LIMITED**

ELECTRO-MECHANICAL DEPARTMENT, COVENTRY

499 GR.

# SPEEDICUT

BRITAIN'S
BEST
**BANDSAWS**
and
**HACKSAWS**

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*The Hallmark of Engineers' Cutting* **TOOLS**

*Made in Britain's Largest Engineers' Tool Factory*
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# A COMPLETE RANGE OF BRAKES FOR ALL CARS

AUTOMOTIVE PRODUCTS COMPANY LIMITED, LEAMINGTON SPA, WARWICKSHIRE, ENGLAND

REGD. TRADE MARK: LOCKHEED

# SPEEDICUT

BRITAIN'S
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**BANDSAWS**
and
**HACKSAWS**

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# Manumatic

REG'D TRADE MARK

## On the JUBILEE MINX

*We are happy to announce*
*that the Manumatic transmission*
*is now offered as optional equipment*
*on this very attractive car*

The Manumatic transmission system is expressly suited to the medium-size British car, since it is the only system in the world to carry out automatically synchronized gear changes, resulting in easier two-pedal driving and a much smoother ride.

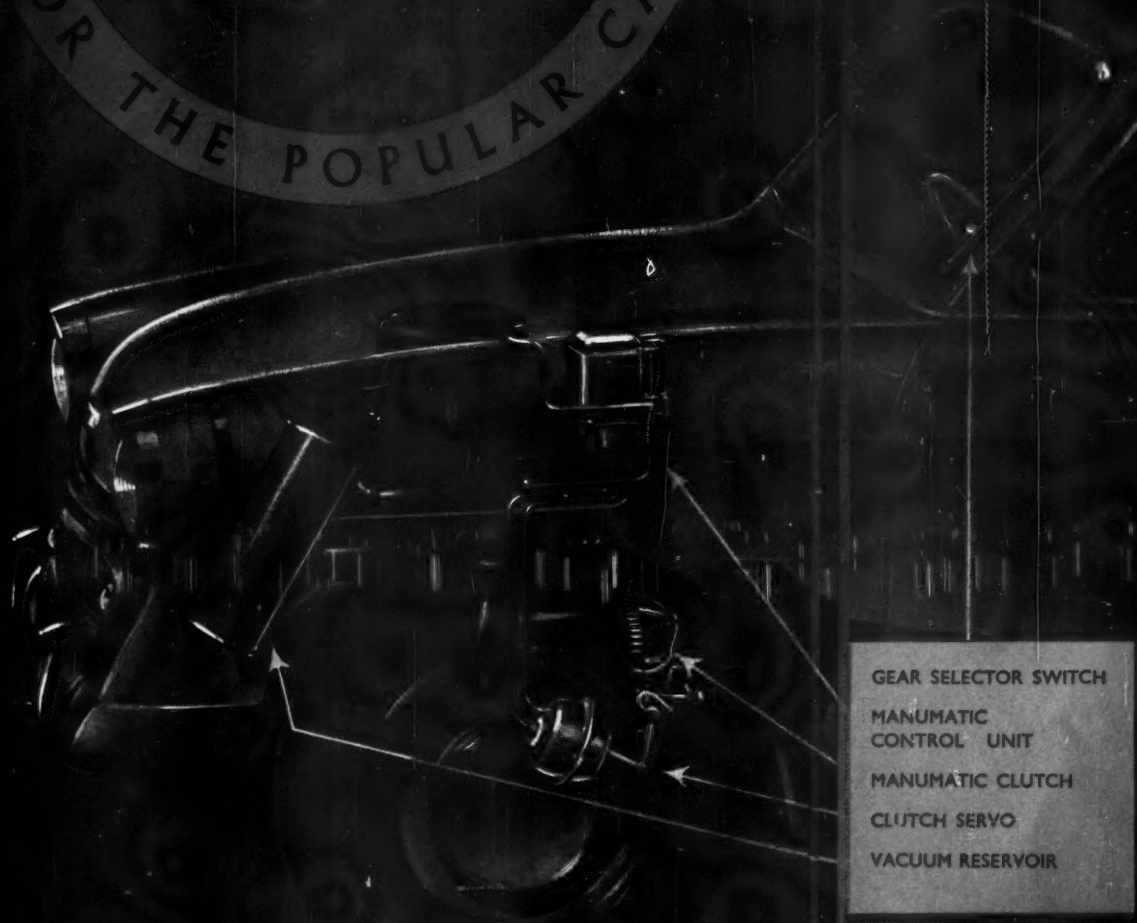
To the car manufacturer, Manumatic offers the outstanding advantage of utilizing the standard synchromesh gearbox.
The illustration shows the Manumatic system on the Jubilee Minx. It is also available as an extra on the Austin A55, Morris Oxford Series III, M.G. Magnette and Wolseley 15/50.

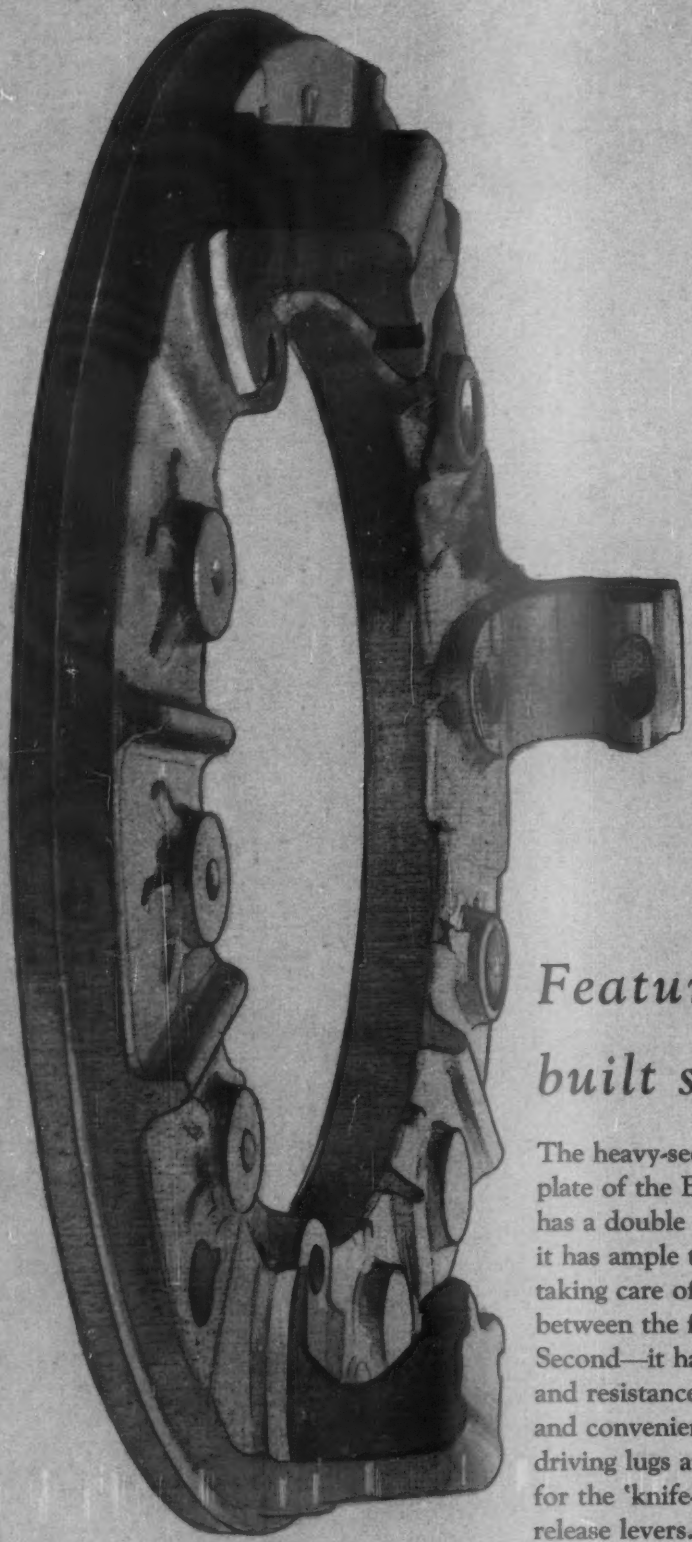
AUTOMOTIVE PRODUCTS COMPANY LIMITED
LEAMINGTON SPA, WARWICKSHIRE, ENGLAND

THE PERFECT SYSTEM

# Manual selection automatic change

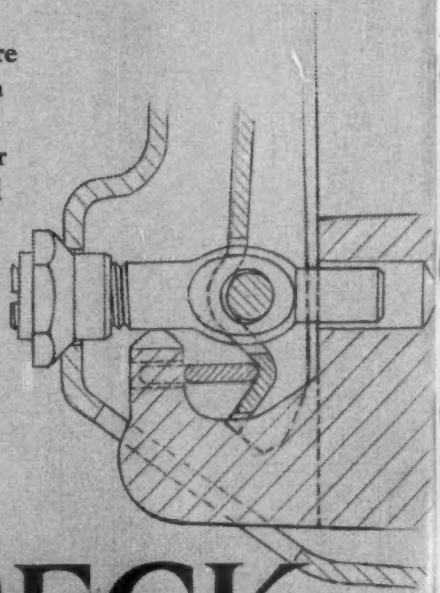
FOR THE POPULAR CAR





## *Features that have built success*

The heavy-section of the pressure plate of the Borg & Beck clutch has a double significance—first it has ample thermal capacity for taking care of the heat generated between the friction surfaces. Second—it has great rigidity and resistance to distortion, and conveniently combines the driving lugs and the abutments for the 'knife-edge' struts of the release levers.



# BORG & BECK

REGISTERED TRADE MARK: BORG & BECK

BORG & BECK COMPANY LIMITED, LEAMINGTON SPA, WARWICKSHIRE

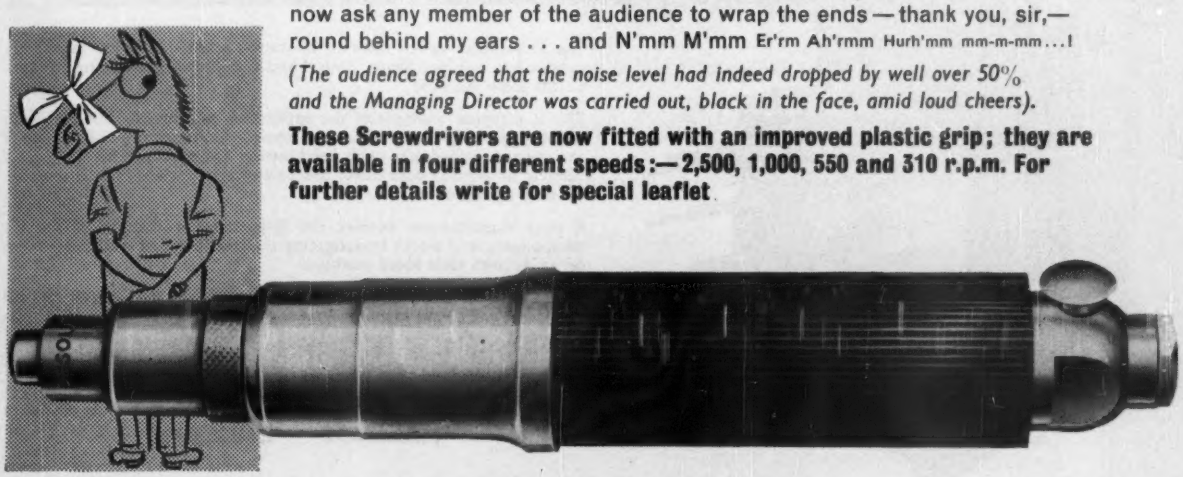
# *Silence* IS GOLDEN

Never satisfied! Always improving! A steady progress towards perfection—*burbled the Managing Director in his most self-satisfied voice.*
Take Pneumatic Screwdrivers. Efficient, you say—but perhaps a trifle noisy for the assembly line.

Sir, you are living in the past. This Little Horse here *(" this 'ere Little Horse, if you please " muttered the Little Horse in question)* operates a screwdriver. Note that we have fitted him with a kind of gag or muffler, thus reducing the operating noise level by more than 50%. The principle is really very simple—as I will now demonstrate. I place this muffler over my mouth . . . so . . . I will now ask any member of the audience to wrap the ends—thank you, sir,—round behind my ears . . . and N'mm M'mm Er'rm Ah'rmm Hurh'mm mm-m-mm...!

*(The audience agreed that the noise level had indeed dropped by well over 50% and the Managing Director was carried out, black in the face, amid loud cheers).*

**These Screwdrivers are now fitted with an improved plastic grip; they are available in four different speeds:—2,500, 1,000, 550 and 310 r.p.m. For further details write for special leaflet.**



THE NEW **DESOUTTER**
silent screwdriver

Desoutter Brothers Limited, The Hyde, Hendon, London, N.W.9. Telephone: Colindale 6346 (5 lines). Telegrams: Desnuco, Hyde, London
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ASQUITH

# UNIT TYPE MACHINES

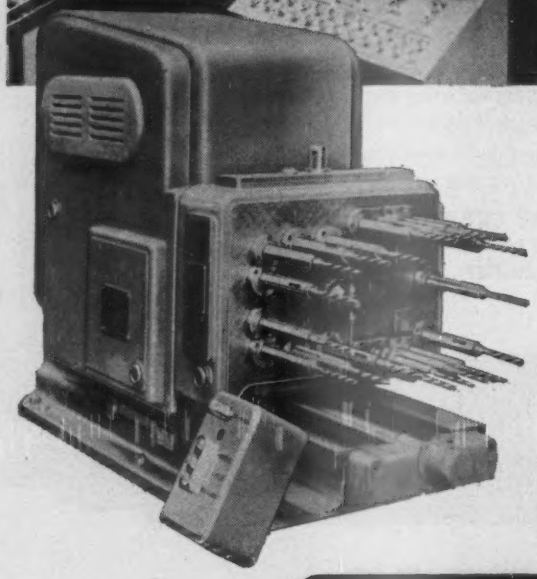
*fully engineered*
*for high-output production*

Individual Head Machines

Multi-Way Machines

Rotary Table Transfer and

In-line Transfer Machines



The illustration above shows a 18-station transfer line for machining automobile cylinder heads, both 4 and 6 cylinder types being handled on the same machine.

This is a typical example of the application of Asquith Unit Heads to the design of high output machine tools. Units from ¼ H.P. upwards are utilized individually or in combination and mounted for horizontal vertical or angular operation; the unit of appropriate H.P. is selected for each operation.

If your manufactures involve the large-scale production of specific components it is worth investigating the possibility of machining them on an Asquith Unit Head machine.

*Write to Drummond-Asquith (Sales) Ltd. giving full details of the component and output required.*

**WILLIAM ASQUITH LTD.**
**HALIFAX · ENGLAND**

*Sales & Service for . . .* **DRUMMOND-ASQUITH** *. . . the British Isles*

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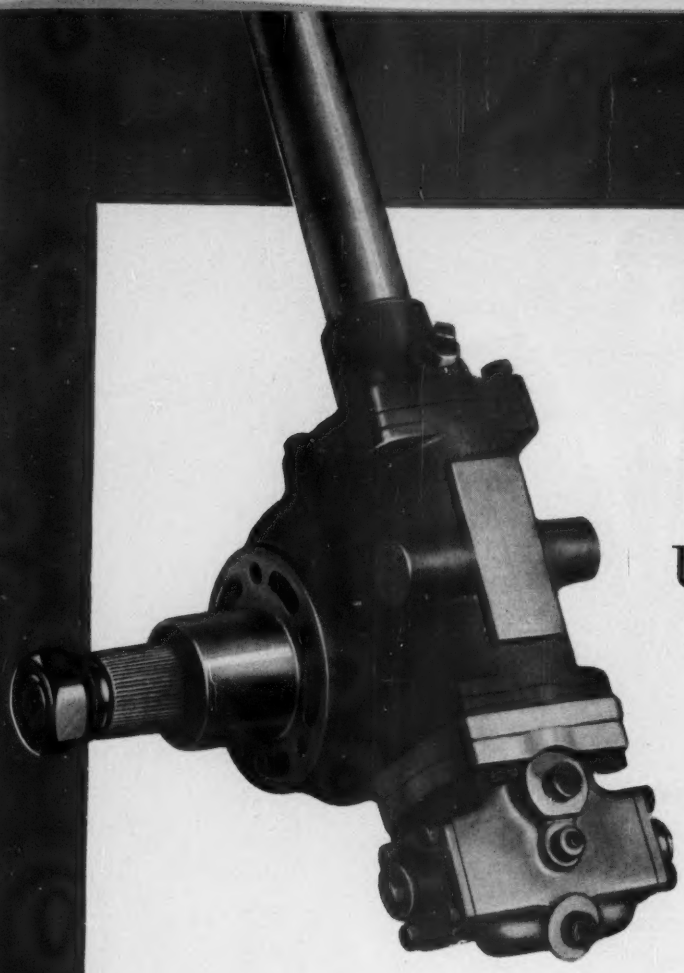
*'Phone : Midland 3431 (7 lines) 'Grams : Maxishape, B'ham. Also at LONDON : Phone : Trafalgar 7224 (5 lines) and GLASGOW : 'Phone : Central 3411*



# THE UNIVERSAL UNIT

Illustrated above is the Type 3 'Universal' steering gear which incorporates the hydraulic control valves mounted upon our type '861' manual gear. This is for use with a separate power pump and with power cylinders operating on the steering linkage. Further particulars will be sent on request.

ADAMANT ENGINEERING CO. LTD., DALLOW ROAD, LUTON

*Sole proprietors of the Marles Steering Company Ltd.*

Telephone: Luton 2662 (4 lines) Telegrams: Adamant, Phone, Luton

MARLES

ASQUITH

# UNIT TYPE MACHINES

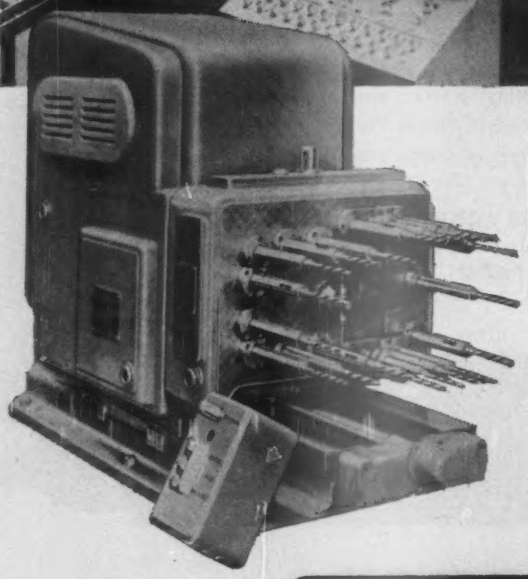
*fully engineered*
*for high-output production*

Individual Head Machines

Multi-Way Machines

Rotary Table Transfer and

In-line Transfer Machines



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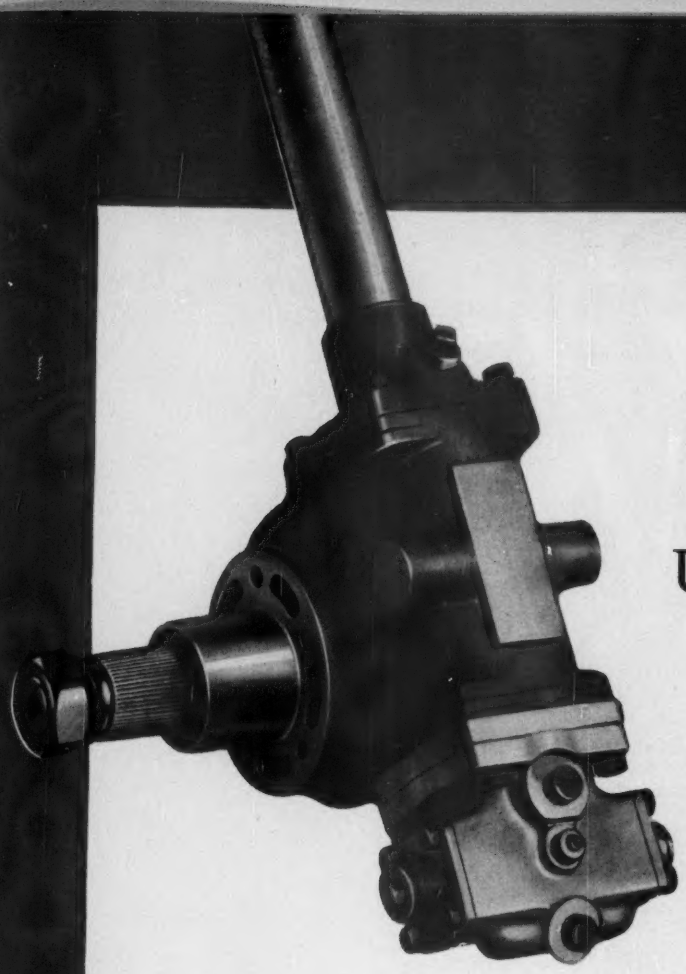

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*Sole proprietors of the Marles Steering Company Ltd.*

Telephone : Luton 2662 (4 lines) Telegrams : Adamant, Phone, Luton

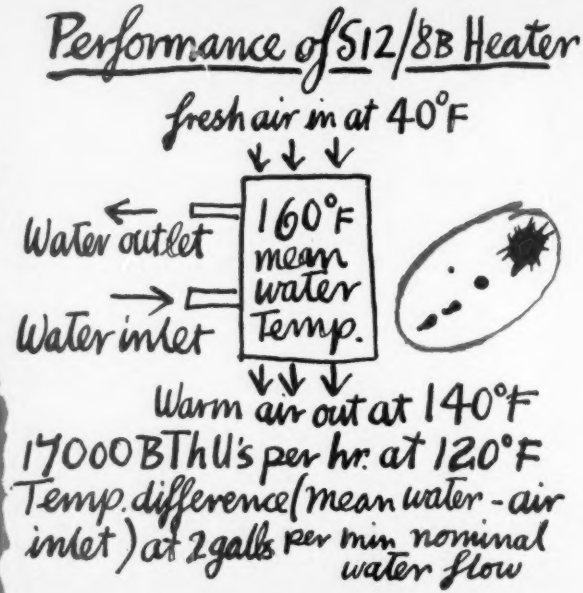
MARLES

# Hey chaps, this is where all the heat comes from . . .

"Not *all* the heat, stupid, only a third of it!— you'll find two more of these if you look hard enough, and there's another of a different type for the driver. I know all about this heating system. It's manufactured by Clayton Dewandre of Lincoln and comprises three S.12 heaters under the seats and a GHD.3 demister for the driver's windscreen — connected to a source of fresh air of course!"

"Just hark at old Hargreaves with all his knowledge."

"Well perhaps I am rather omniscient chaps, but even you must concede that the Clayton claim to 'create the right atmosphere' is completely vindicated!"


Performance of S12/8B Heater
Fresh air in at 40°F
Water outlet
Water inlet
160°F mean water Temp.
Warm air out at 140°F
17000 BThU's per hr. at 120°F Temp. difference (mean water - air inlet) at 2 galls per min nominal water flow

*The S12/8B Saloon heater and the GHD.3 Demister are standard units from the range of C.D. heaters.*

**CLAYTON DEWANDRE CO. LTD.**

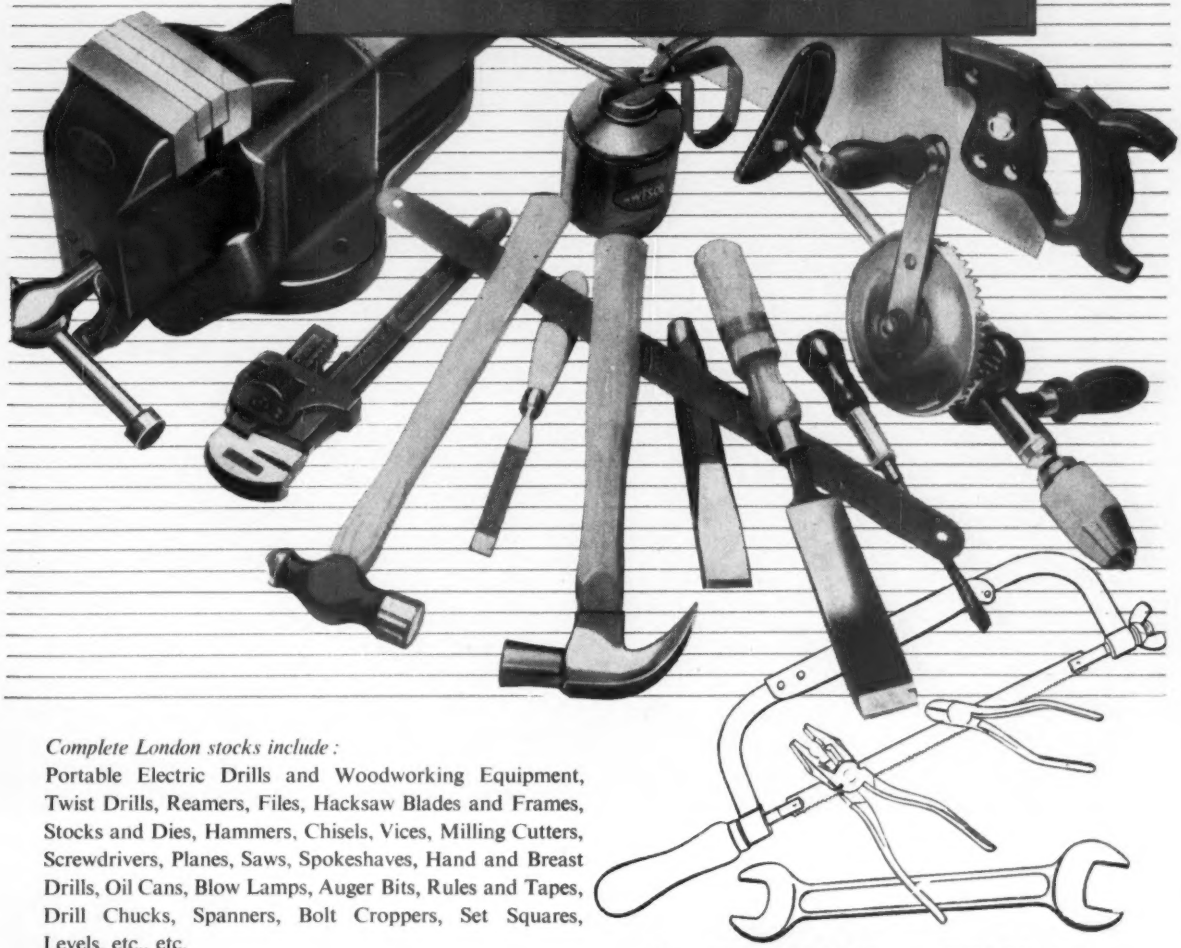
TITANIC WORKS · LINCOLN · ENGLAND · TEL: LINCOLN 11305-9

H3

# You won't often see a *BADLING* OF DUCKS, or a *GAGGLE* OF GEESE, or a *WEDGE* OF SWANS but you'll always find a TON OF TOOLS

*at*

# WALKERS



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*If any of your requirements are in the nature of NON STANDARD or SPECIAL ITEMS to your own particular details contact us if you require assistance, our wide knowledge and experience as SPECIALISTS is at your service.*

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**'Phone: ROYal 8191 (10 lines) 'Grams: Makerlaw, Fen, London**
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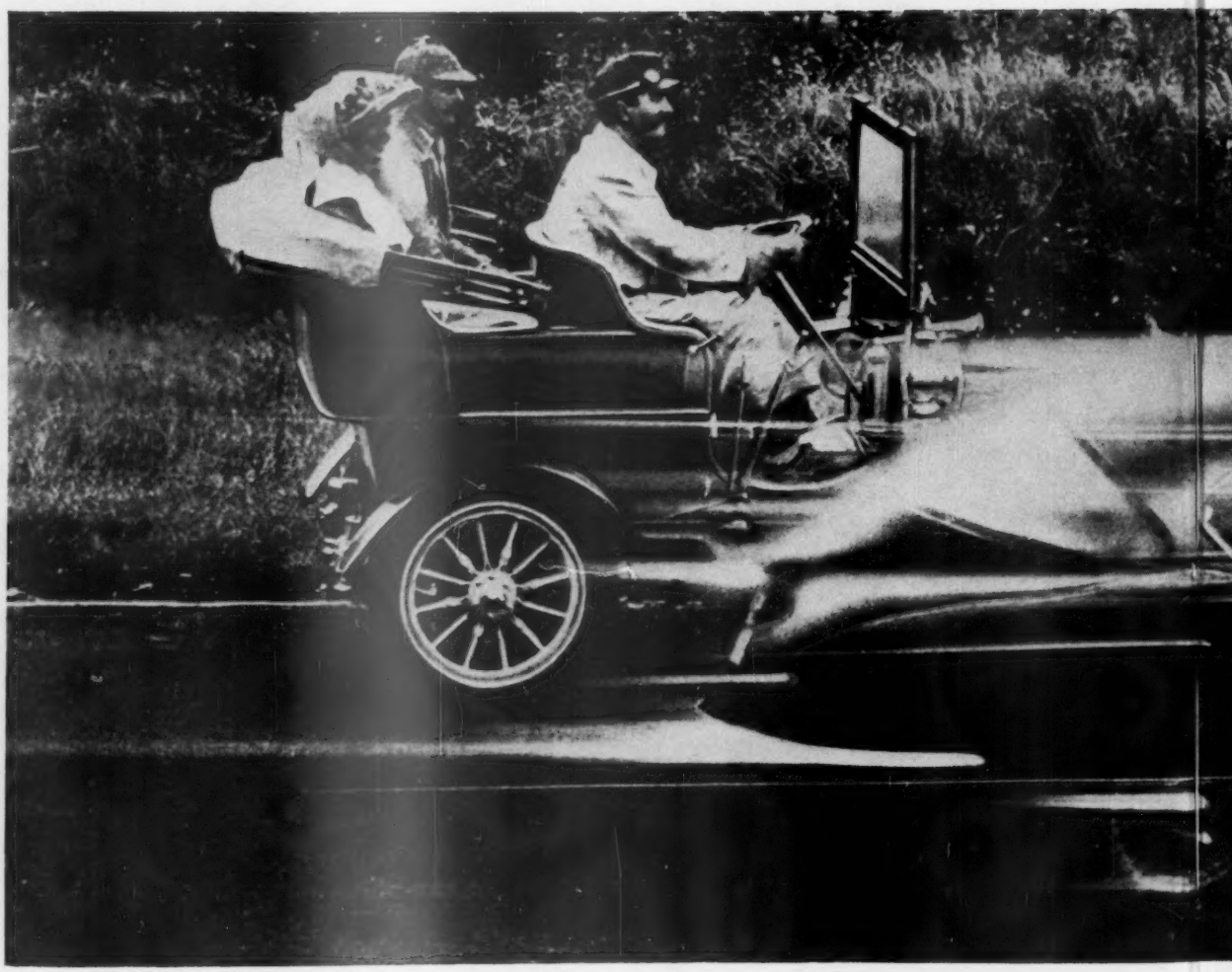

The history of the motor car is the history of **FERODO**

In 1895 the first car had arrived in Britain. In 1896 the three-mile an hour speed limit and the red flag rule had been repealed. Herbert Frood inventor of Ferodo brake linings began his investigations into friction materials in 1897. So the history of the motor car and of Ferodo began together.

Automobile engineers have looked to Ferodo Limited to help solve their friction problems, because improved braking performance must depend, amongst other factors, on better and better friction materials. They will continue to receive in the future, as they have in the past, the full backing of Ferodo research and technical service, developing new materials, new methods to control the increasingly high performance of modern cars.

**Anti-Fade Brake Linings · Disc Brake Pads · Clutch Facings · Fanbelts**

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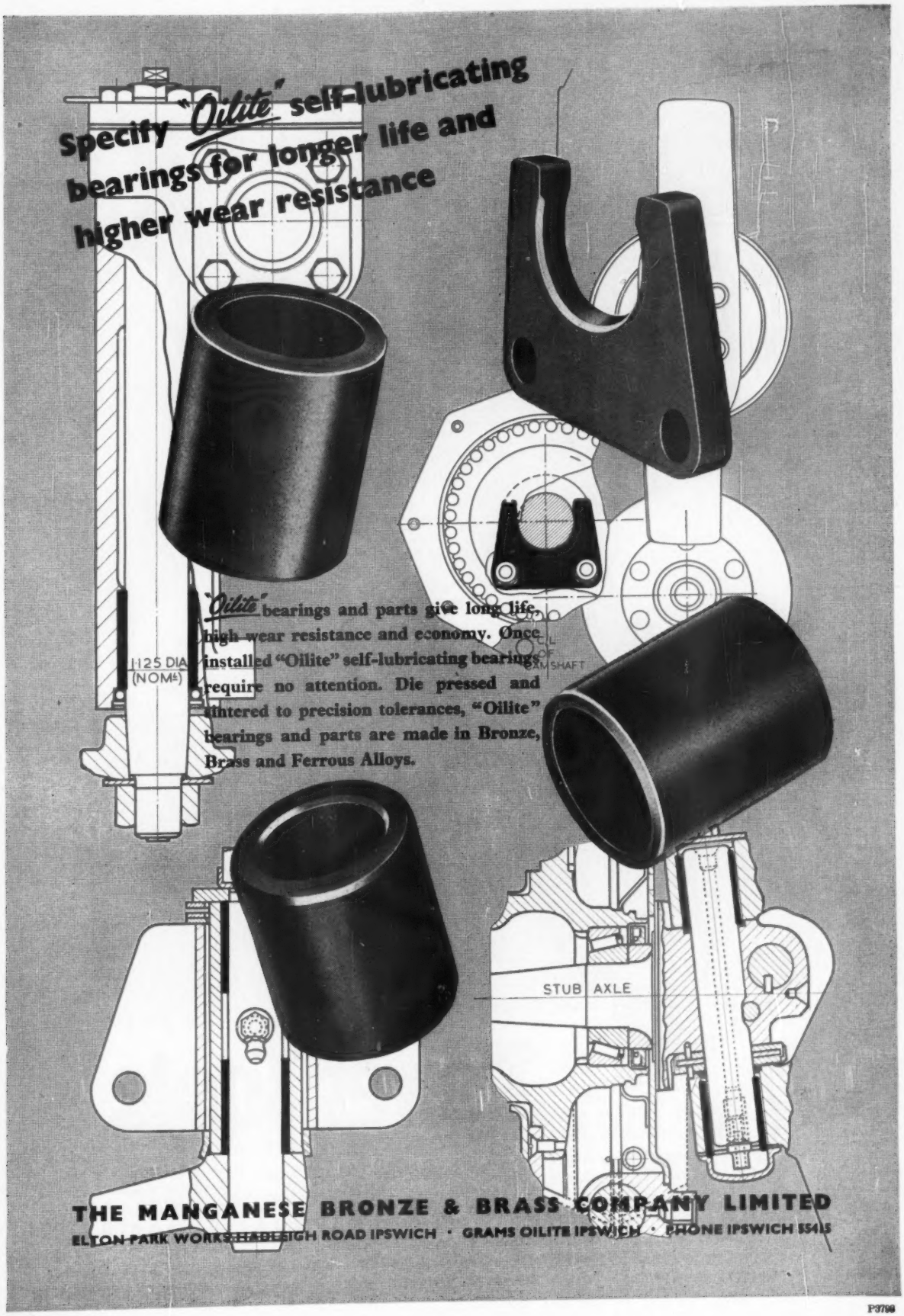
British Oxygen Gases Ltd., Spencer House, 27, St. James's Place, London, S.W.1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"Oilite" bearings and parts give long life, high wear resistance and economy. Once installed "Oilite" self-lubricating bearings require no attention. Die pressed and sintered to precision tolerances, "Oilite" bearings and parts are made in Bronze, Brass and Ferrous Alloys.
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## tool for productivity

Increase total output per shift with this ARMSTRONG WHITWORTH Impact Wrench. Designed for heavy duty it reduces operator fatigue and withstands, long, hard service.



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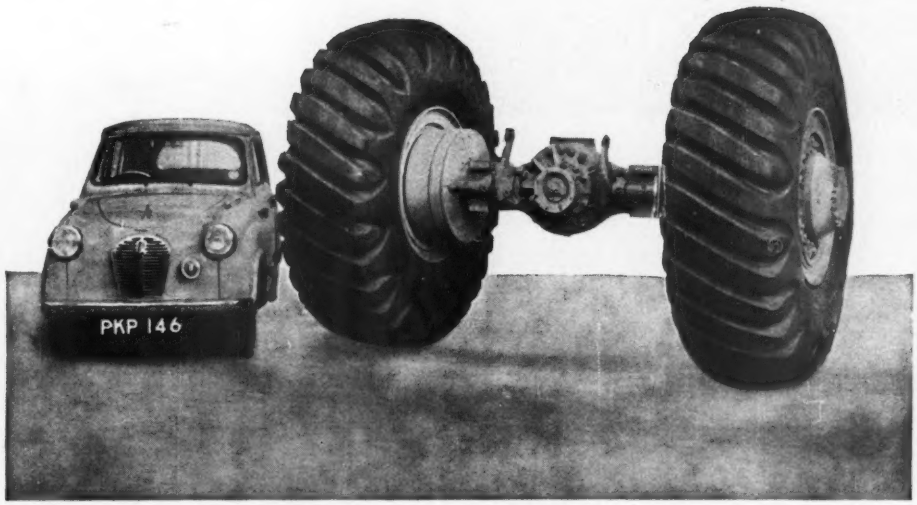


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LEEDS, 5

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the metal you know . . . . .

. . . . . on a car you know

*The Ford Zephyr*

Men in industry know the value of stainless steel
as do housewives with their preference for the high lustre
of attractive articles in the kitchen.
Stainless steel is stainless right through, not skin deep,
it is tough, durable and corrosion-resistant.
Trim stays new looking with normal care
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The fittings count a lot
—make sure your new car has stainless steel trim.

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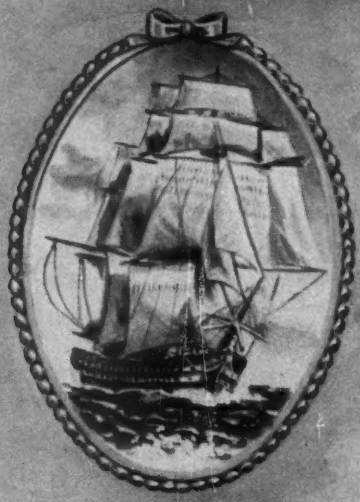
*Telephone:* Sheffield 42051



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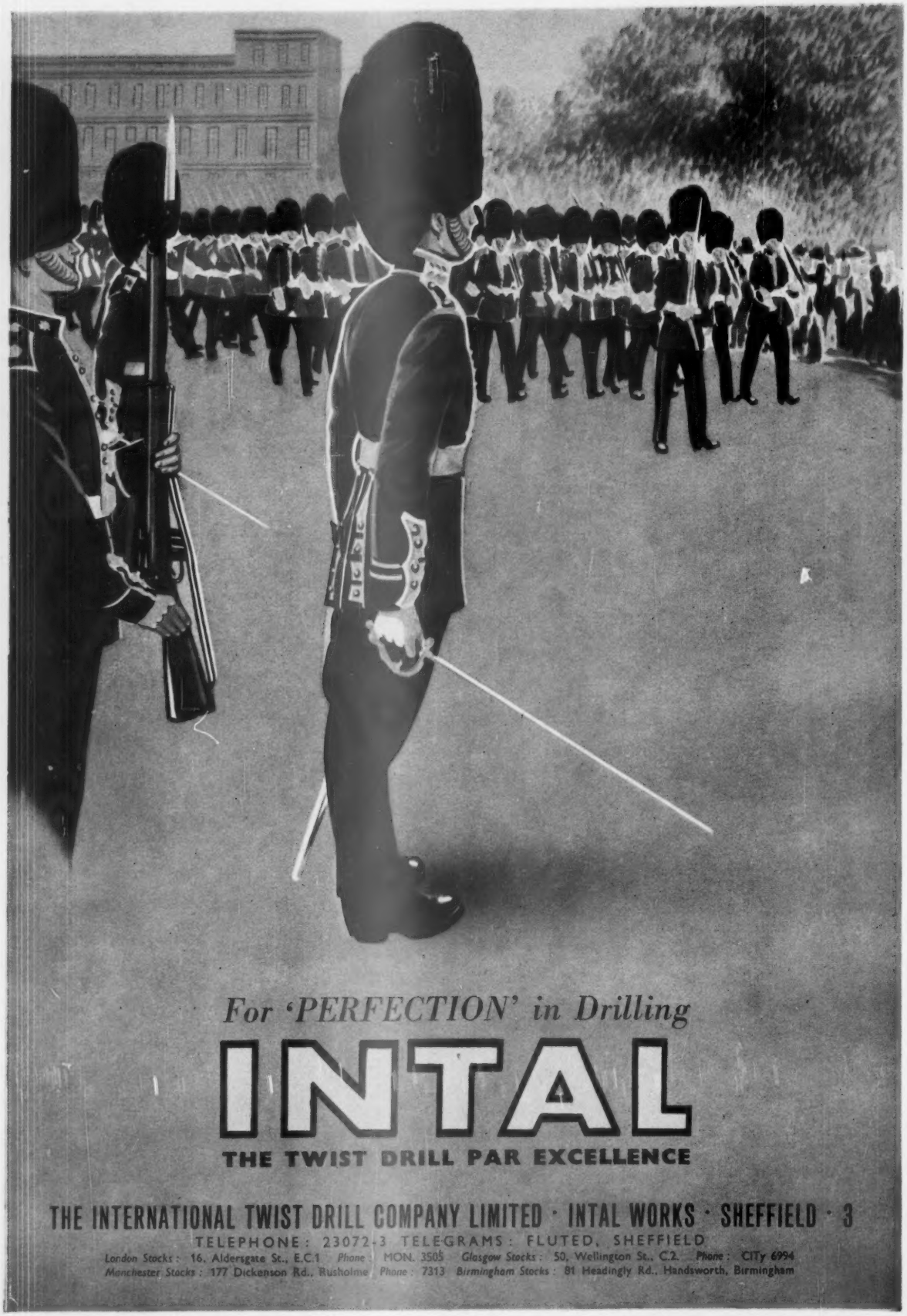
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# ECONOMY

## with

## Ley's 'Black Heart' Malleable Castings

This front engine mounting bracket for a tractor is a single casting replacing an assemblage of numerous parts.
The castability of this material permits effective distribution of the metal and is typical of the many applications where economical production results from the use of Ley's "Black Heart" Malleable.

LEY'S MALLEABLE CASTINGS CO. LTD., DERBY
TELEPHONE : DERBY 45671

***EUROPE'S LARGEST MALLEABLE PRODUCERS***

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Diecastings as strong as steel
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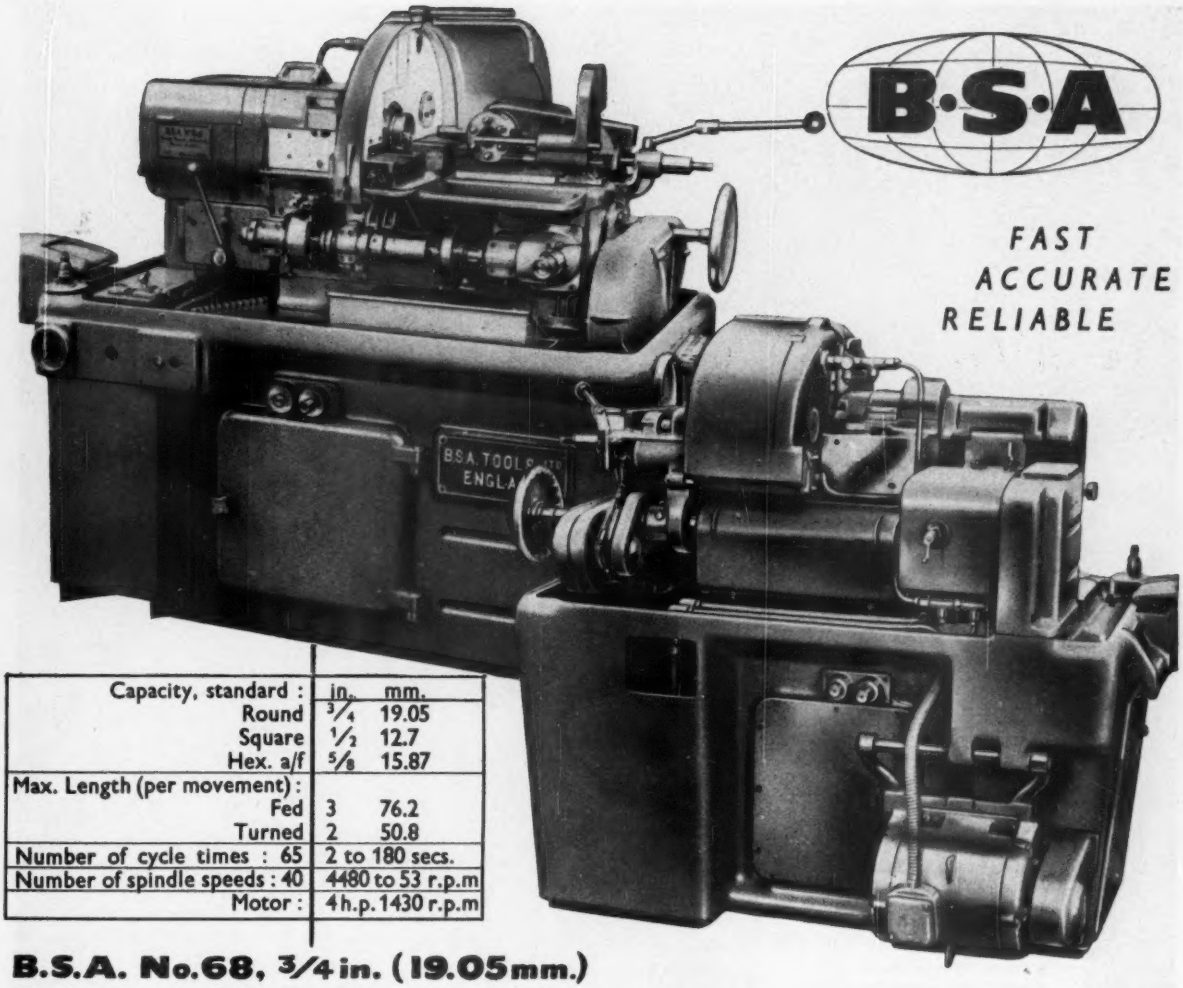
Telegrams "ABCO WALSALL"

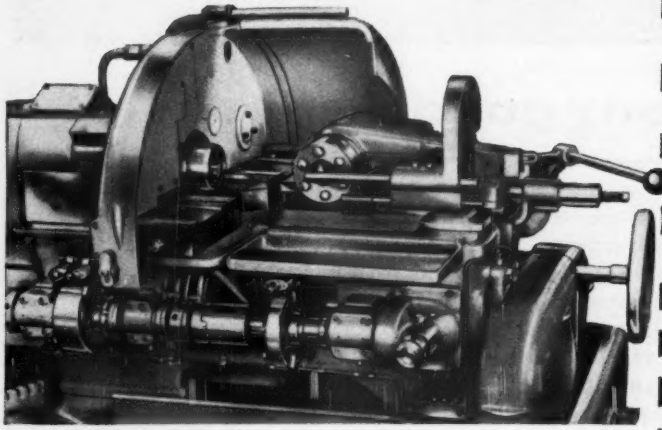
B·S·A

FAST
ACCURATE
RELIABLE




| Capacity, standard : | in. | mm. |
|---|---|---|
| Round | 3/4 | 19.05 |
| Square | 1/2 | 12.7 |
| Hex. a/f | 5/8 | 15.87 |
| Max. Length (per movement) : | | |
| Fed | 3 | 76.2 |
| Turned | 2 | 50.8 |
| Number of cycle times : 65 | 2 to 180 secs. | |
| Number of spindle speeds : 40 | 4480 to 53 r.p.m | |
| Motor : | 4 h.p. 1430 r.p.m | |

**B.S.A. No.68, 3/4 in. (19.05mm.)**



- All the latest developments for high-speed production to close limits of accuracy.
- Designed for ease of operation and simple and rapid change- over.
- Six-station turret is adjustable forwards or backwards in relation to its slide to facilitate tool setting.
- The cross slides are independently adjustable forwards or backwards relative to the spindle centre.
- Third (or vertical) slide supplied as standard equipment.
- Mechanisms protected against the ingress of swarf.
- The spindle is driven smoothly and positively by chains.
- Automatic lubrication to headstock, cross-slides, and gear box, with a centralised system for all other bearings.
- Camshafts, cycle-time and spindle-speed-change pick-off gears all readily accessible.
- Highly efficient guarding and other safety features.
- Built to withstand constant high-speed operation.

*A wide variety of B.S.A. tools and attachments are available for this machine. One of the B.S.A. ½" to 2" capacity range of high-production automatics.*

*EARLY DELIVERY*

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**NEEDLE BEARINGS**
**GIVE YOU THESE BENEFITS**

- compactness and light weight
- unequalled radial load capacity
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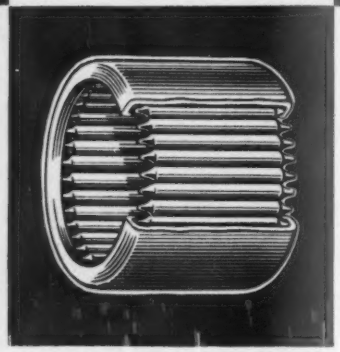
- low unit cost
- run on hardened shafts
- allow larger and stiffer shafts



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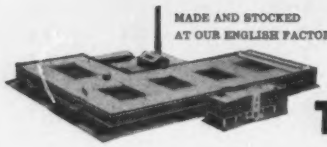

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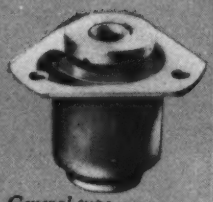
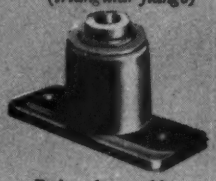
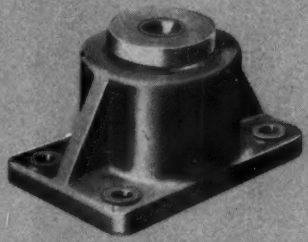


*General type (triangular flange)*

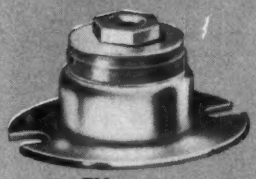


*Pedestal assembly*



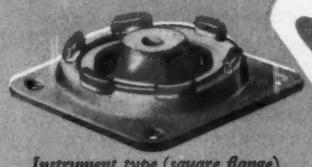
*Pedestal mounting*

*Frustacon type*

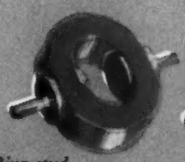


*FN type*

*Instrument type (pedestal flange)*



*Instrument type (square flange)*



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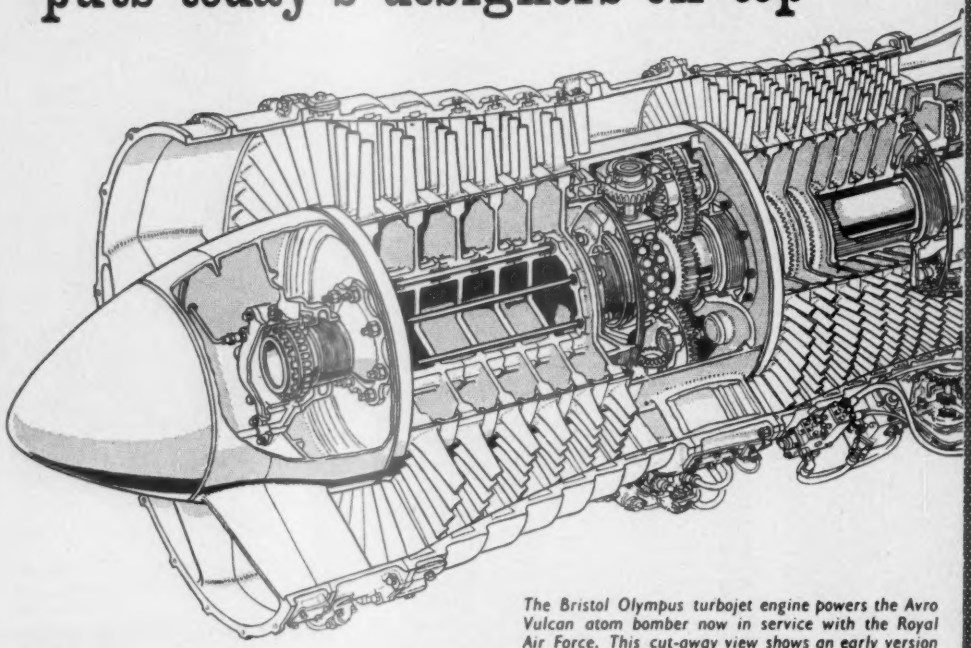

*The Bristol Olympus turbojet engine powers the Avro Vulcan atom bomber now in service with the Royal Air Force. This cut-away view shows an early version now off the secret list. All Bristol engines are fitted with Ransome & Marles Bearings.*

*Drawing by "Flight."*

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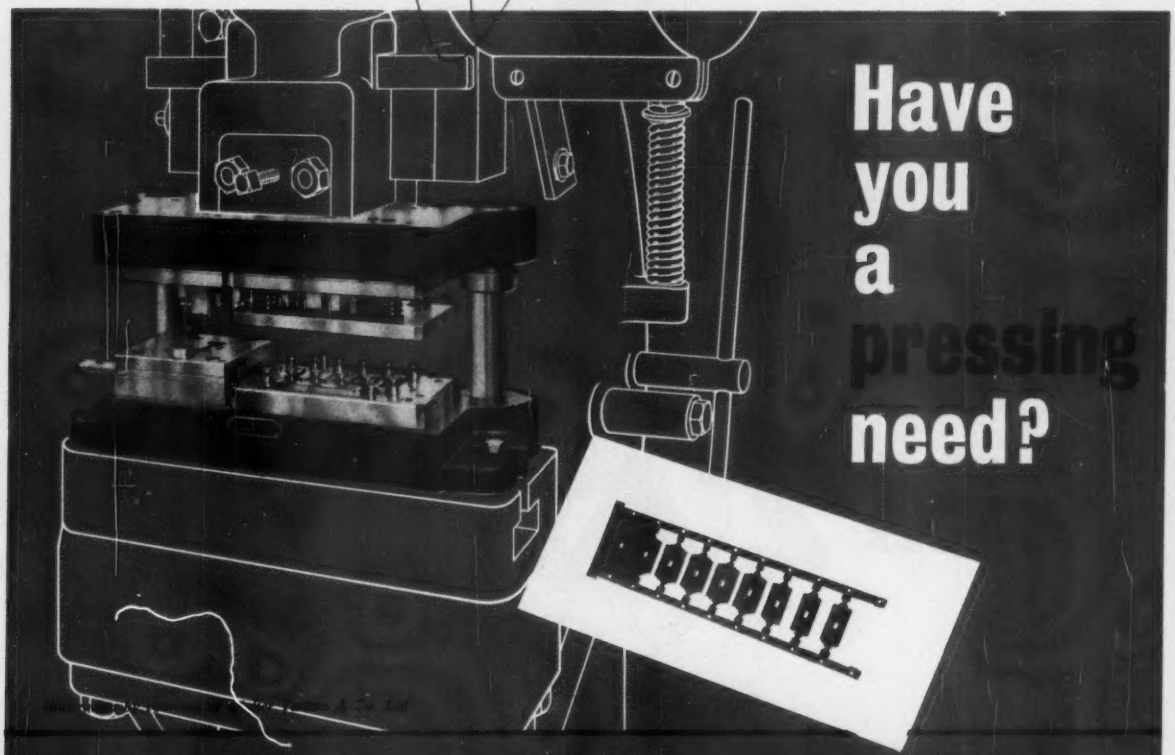

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*Stocks held in Sheffield and London.*

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# moulded brake

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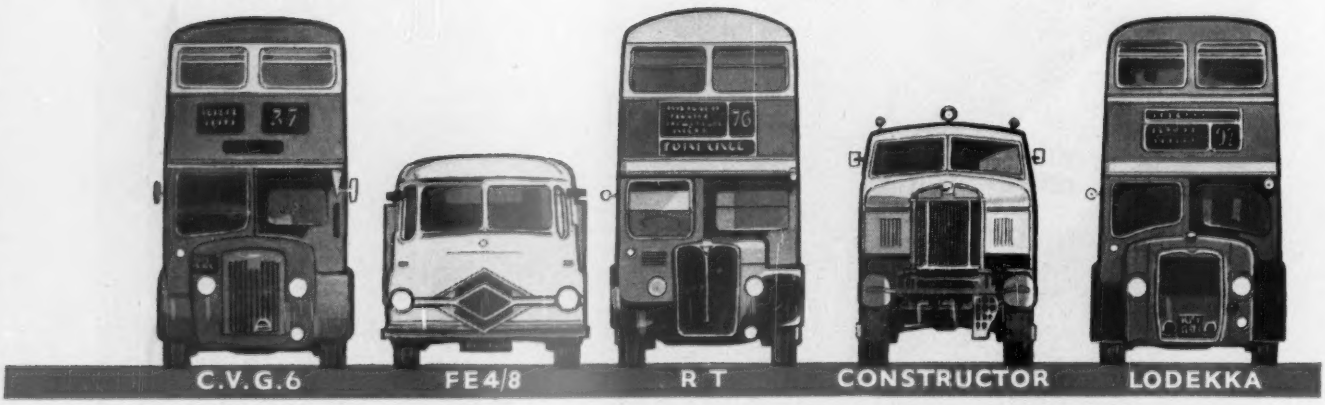


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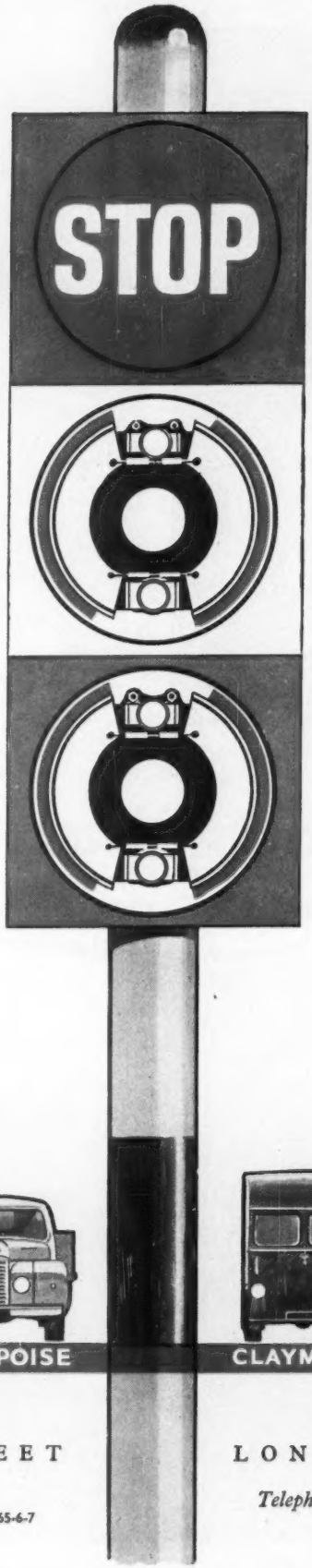


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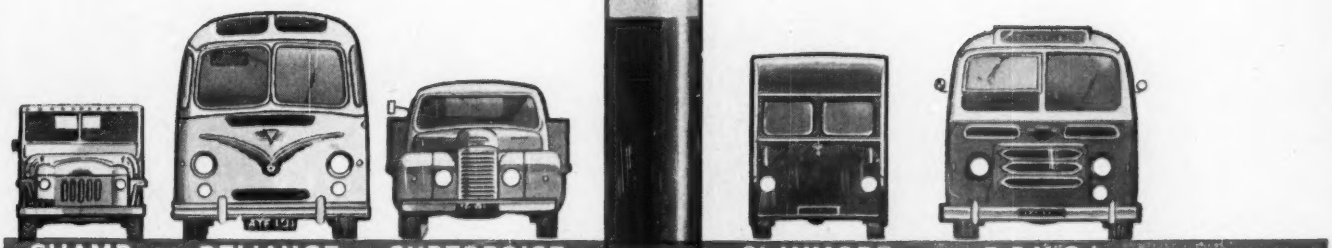


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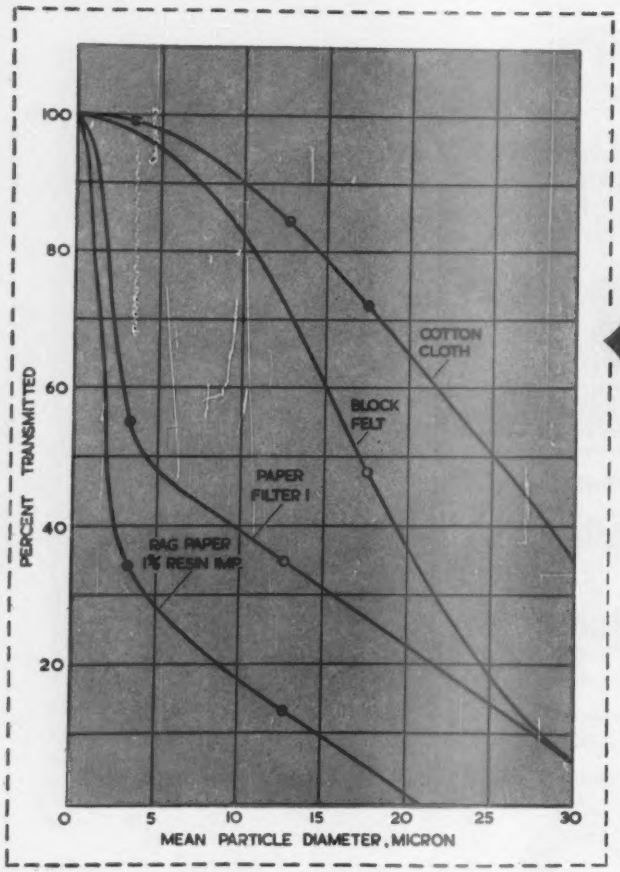
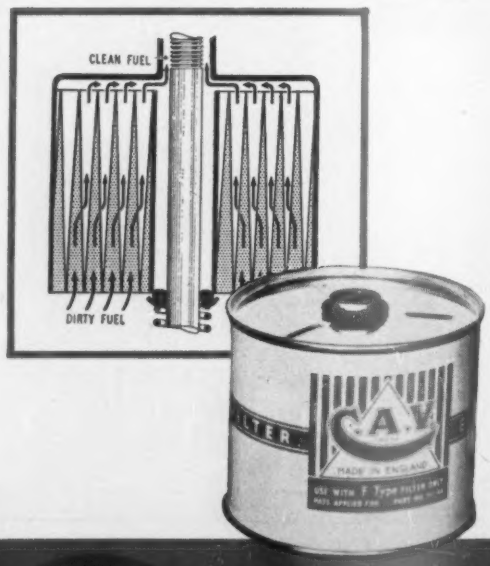
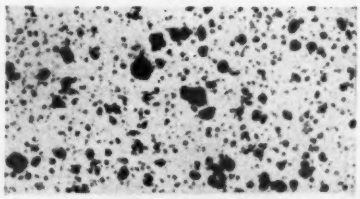



# TESTS SHOW SUPERIORITY OF SPECIAL PAPER ELEMENT USED IN C.A.V. 'F' TYPE FUEL FILTER

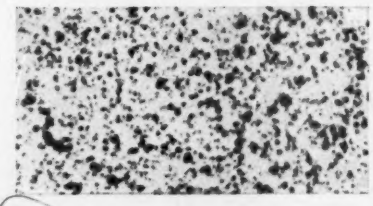
Dust particles of any size carried in diesel fuel cause wear of injection equipment, but for a given weight of abrasive the wear is initially more rapid the smaller the particle size. The most damaging size of particle lies in the 6 to 12 micron range. Laboratory tests on the particle transmission of various filters were made, using specially prepared and graded dusts. The graph shows the specially treated paper used for the C.A.V. type 'F' filter to be by far the most effective material. ***Further tests showed that the life of pump elements was increased by as much as 6 times over that obtained with a cloth filter.***

The photomicrographs show fuel before filtering, after passing through a block felt filter, and after filtration through a C.A.V. paper element filter.



(1) *Photomicrograph* (x 100) *of fuel containing dust and dirt, before filtration.*



(2) *The same fuel as in* (1) *after passing through a block felt filter.*

(3) *The same fuel as in* (1) *after passing through a C.A.V. paper element filter.*

C.A.V.

The World's Leading Manufacturers of

FUEL INJECTION EQUIPMENT

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# Smethwick Drop Forgings

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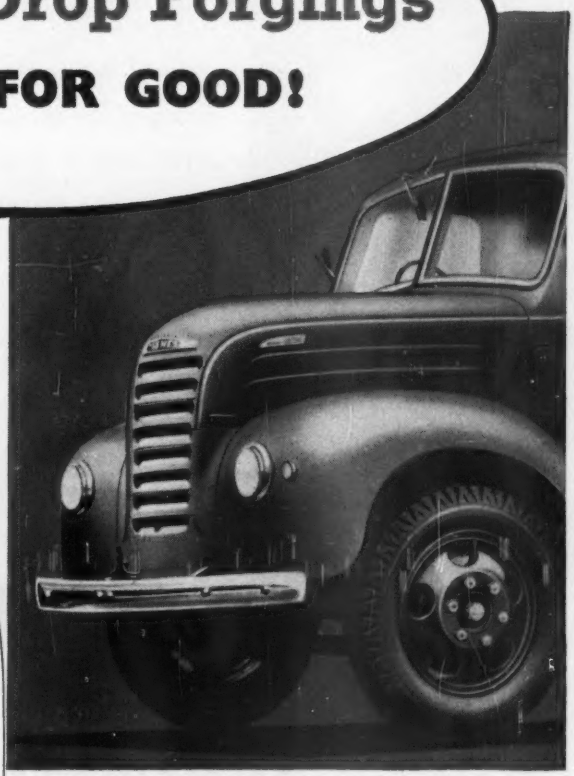

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# A-MP modern solderless terminations

TRADE MARK

## *for every automotive application*

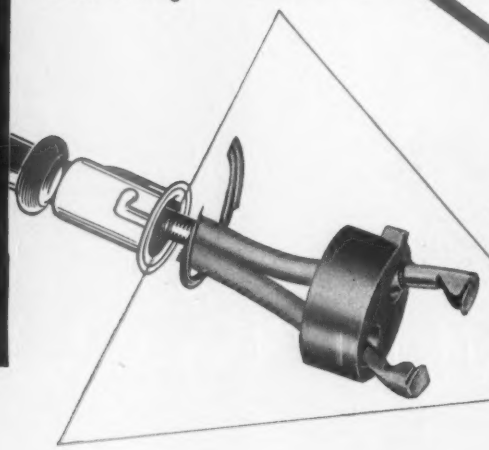
Wherever there is a wire
there is an **A-MP*** Solderless Terminal to connect it.

- Top electrical and mechanical performance.
- The pressure-crimp eliminates the necessity for soldering and welding.
- **A-MP** automatic machines crimp up to 4000 uniform terminations per hour.
- Adopted by American car and truck manufacturers.

Investigate the advantages of **A-MP** creative approach to Better Wiring.

**A-MP SYSTEMS AID EXPORTS**

The **A-MP** solderless method meets wire termination specifications in foreign countries. Use of the **A-MP** method will enable you to compete in world markets. It is particularly significant that **A-MP** systems are standard practice in the U.S.A.



This **A-MP** solderless Button Contact, specially designed for automotive light sockets is made in strip terminal form and supplied on reels for automatic machine application. High-speed automated terminations ensure uniform high quality and reduce costs.

A-MP*
TRADE MARK

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Works: SCOTTISH INDUSTRIAL ESTATES, PORT GLASGOW, SCOTLAND

*Trade Mark of AMP Incorporated, U.S.A.

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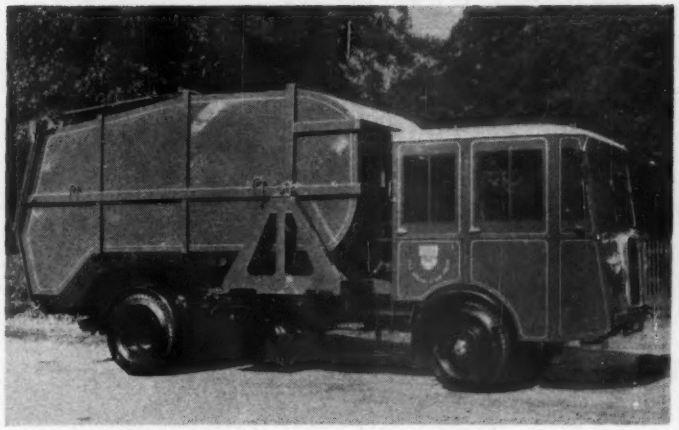
# They can't all be wrong!

**MUNICIPAL TRANSPORT ENGINEERS & FLEET OPERATORS the World over—are fitting Cromard, the hard chrome cylinder liners that defy cylinder wear to the engines of their fleets.**

**The bugbear of cylinder wear—entailing costly premature overhauls and lost working hours, becomes a thing of the past because the entire life of the engine is prolonged.**

**Certain manufacturers are fitting Cromard liners as standard or making them available as optional equipment.**

**Shelvoke & Drewry Ltd. manufacturers of the well-known S.D. Freighters were the first to standardise Cromard liners in both petrol and diesel versions.**



*By courtesy of Shelvoke & Drewry Ltd.*

*By courtesy of the London Co-operative Society.*

**Cromard users include household names in the Food Industry, Building and Public Works, Municipal Cleansing fleets, Bus and Coach operators, Steel manufacturers—can they all be wrong?**

**Cromard liners are available for Austin, Albion, Bedford, Commer, Dennis, Dodge, Ford, Land Rover, Leyland, Morris, Perkins, S.D. Freighter, Thorneycroft and many others.**

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**LAYSTALL ENGINEERING COMPANY LTD.**

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***Telephone: WATerloo 6141***

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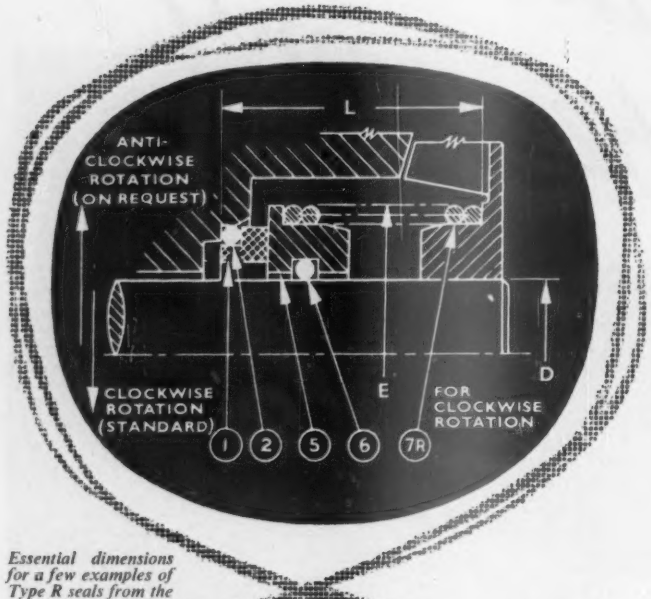
# whatever the size of coolant pump




*Essential dimensions for a few examples of Type R seals from the wide range available.*

**FLEXIBOX MECHANICAL SEALS FOR AUTOMOBILE COOLANT PUMPS**

| Seal type for clockwise rotation. | D Ins. ±0.002 | E Ins. | L Ins. ±0.010 |
|---|---|---|---|
| A12R | 0.500 | 1.075 | 0.96 |
| A58R | 0.625 | 1.20 | 1.04 |
| A34R | 0.75 | 1.424 | 1.41 |
| A78R | 0.875 | 1.52 | 1.16 |
| A100R | 1.000 | 1.70 | 1.16 |
| A118R | 1.125 | 1.861 | 1.16 |
| A114R | 1.250 | 2.003 | 1.312 |

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**MECHANICAL SEALS**

## banish leakage and noise

With a minimum of working parts the Flexibox Mechanical Seal Type R effectively prevents coolant pump leakage and is completely noiseless in operation. A further advantage is the small outside diameter which improves the hydrodynamics of the impeller. A wide range of sizes is available—the table shows a few typical examples—and each seal incorporates the unique Flexibox resilient spring drive. Flexibox seals are now fitted to the coolant pumps of some of the world's most famous car engines.

*Flexible Type R Seal*

*Full technical data from*

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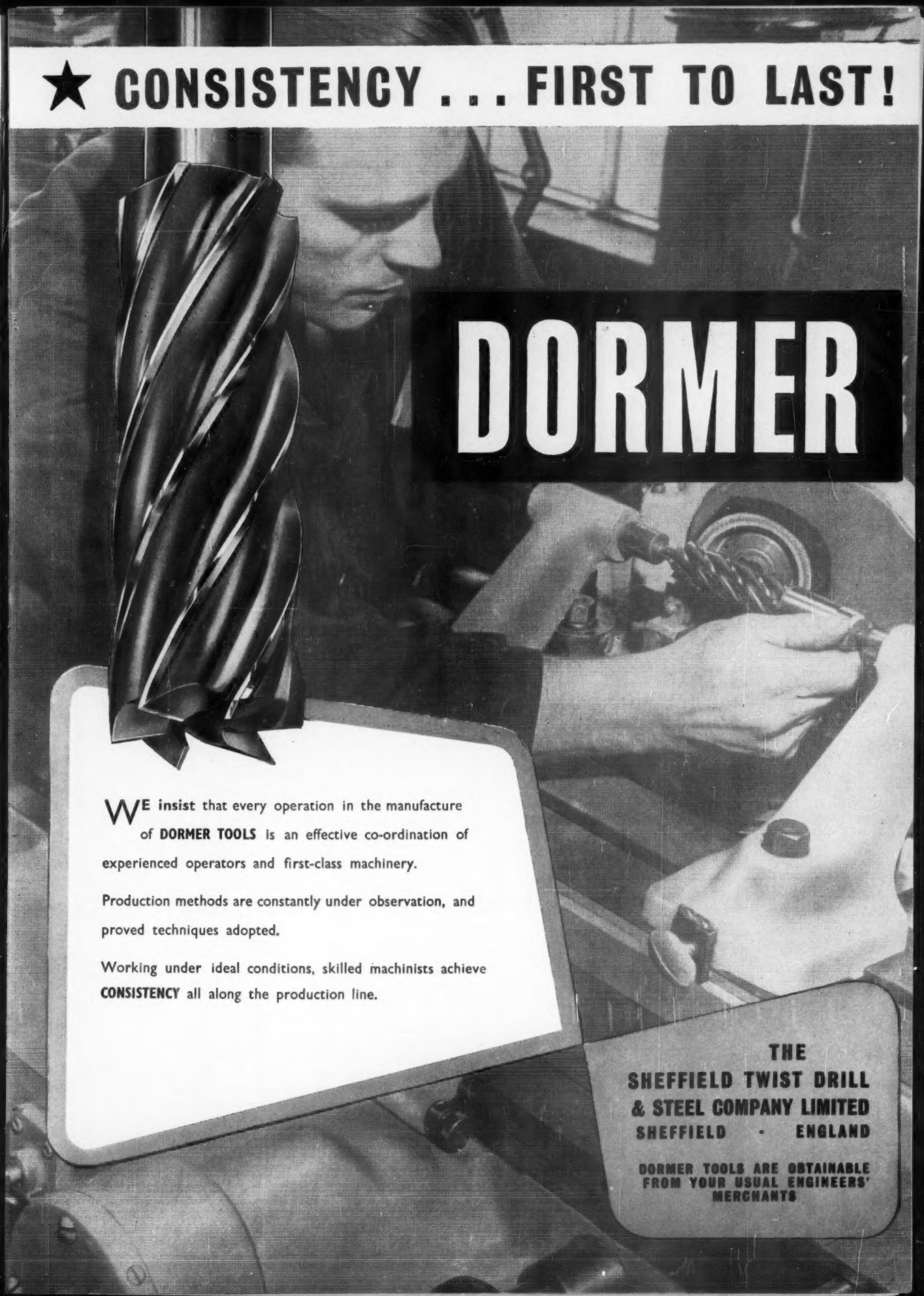

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WE **insist** that every operation in the manufacture of **DORMER TOOLS** is an effective co-ordination of experienced operators and first-class machinery.

Production methods are constantly under observation, and proved techniques adopted.

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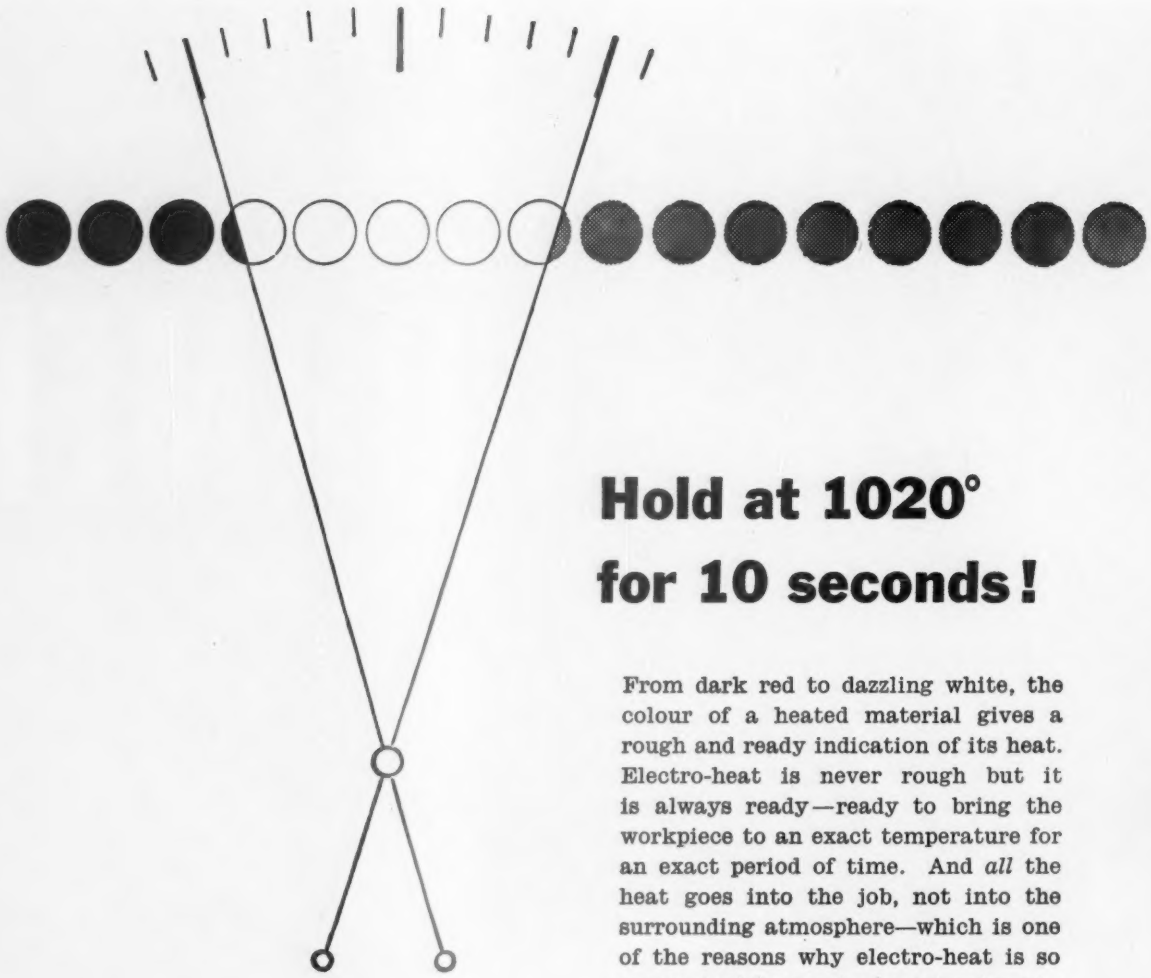
**DORMER TOOLS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS**



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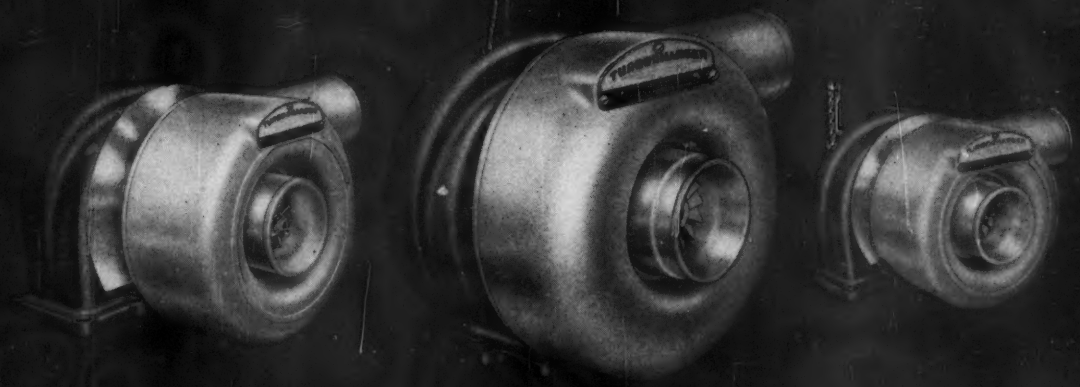
# SCHWITZER TURBOCHARGER



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These HOLSET dependable turbos of SCHWITZER design backed by over one hundred million miles of proven commercial operation in the U.S.A., are now available for the first time to engine manufacturers in the United Kingdom and on the Continent of Europe.

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★ Unequalled automotive turbo experience in PETROL and DIESEL installations.

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## OIL ENGINE DIVISION
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*Above: Casting for Water Pump body. Casting weight 22 lbs.*

*Left: Timing Wheel Case. Casting weight 72 lbs.*

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**Harper Castings are consistent in their accuracy of dimension and excellent machining properties—they have a high degree of finish and an enviable reputation for quality.**

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# Laycock Overdrive

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Singer **GAZELLE**, 1½-litre. Laycock de Normanville Overdrive optional (3rd and top gears)

Aston Martin **DBIII**, 3-litre. Laycock de Normanville Overdrive optional (top gear)

Most British manufacturers approve Laycock de Normanville overdrive. It adds flexibility to an already impressive performance, and gives worthwhile petrol economy ... and the Laycock overdrive system is safe, because it is always positively engaged.

**The Laycock Overdrive is available on more than 30 British cars.**

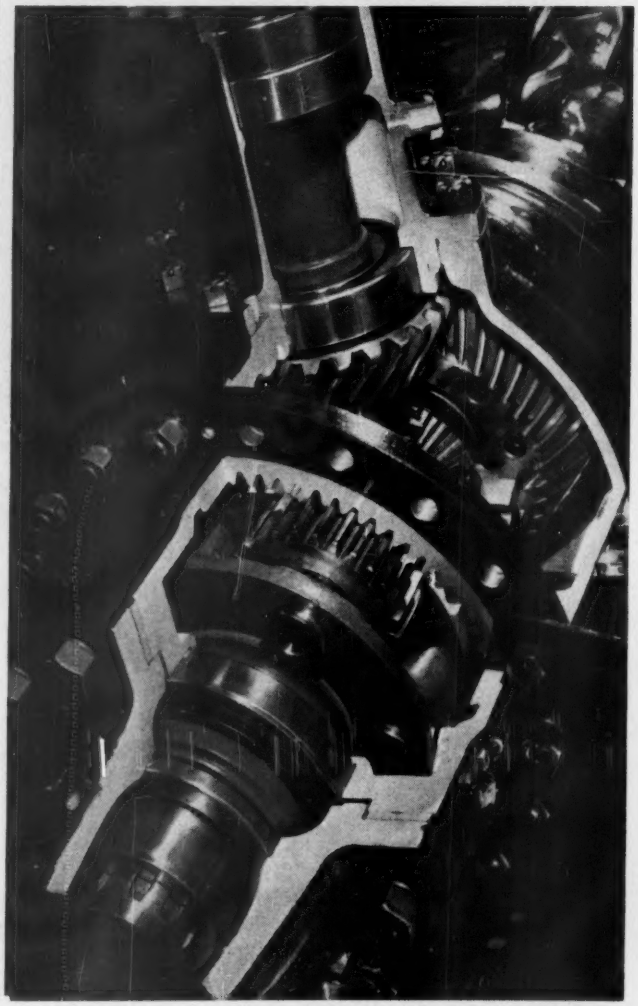
*Enquiries to:* **AUTOMOTIVE DIVISION, LAYCOCK ENGINEERING LIMITED · SHEFFIELD**

*when the going is tough . . . .*

*DROP FORGINGS*

*by*

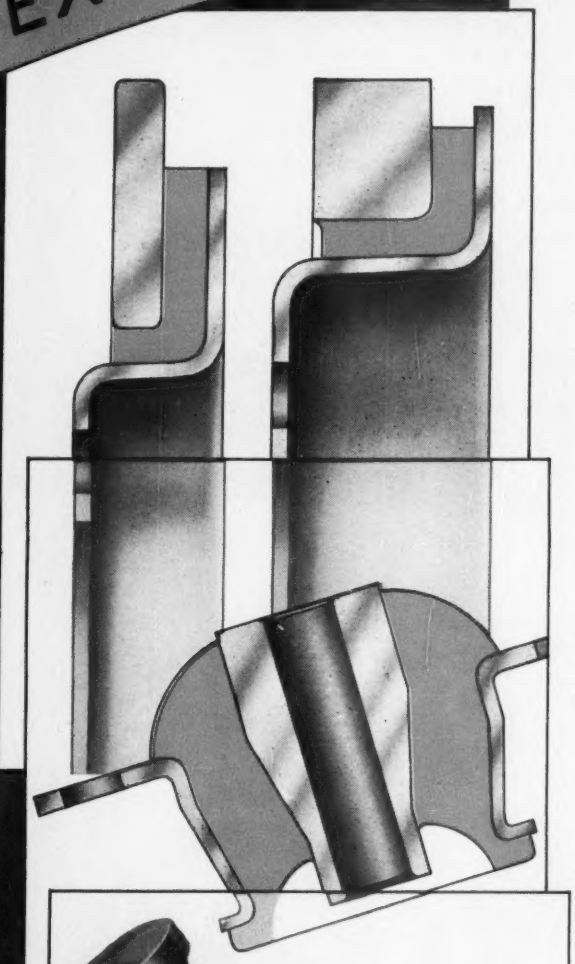
**FIRTH-DERIHON**
**SHEFFIELD**
**& DARLEY DALE**



*Heavy duty axle. Scammell Lorries Ltd.*

THE FIRTH-DERIHON STAMPINGS LIMITED, SHEFFIELD

EXPERIENCE THAT OVERLAPS



# Cumulative benefits from Metalastik specialization

Every Metalastik component—whatever its function—benefits from the experience we have gained in solving previous problems, and in its turn paves the way for further advances.

Metalastik leadership is the outcome of this deep-rooted specialization and has established rubber-bonded engineering as a necessity to the motor industry.

These components are typical of Metalastik leadership:

## TORSIONAL VIBRATION DAMPERS

No component in the world is so simple and yet so efficient in performing an important duty as the Metalastik torsional vibration damper. By analysing the requirements, Metalastik can design and manufacture dampers to suit any engine.

## "METACONE" MOUNTINGS

For engines, bodies, cabs and many other diverse applications Metacone mountings are another example of Metalastik success. With the rubber-to-metal weld to both inner and outer sleeves, creep is prevented and vibration-absorbing properties remain constant in service. Available in many designs for a wide range of loads and deflections.

## HIGH-DUTY AND ULTRA-DUTY SHACKLE PINS

The excellent performance of these shackle pins which now have millions of trouble-free miles behind them is endorsed by their continued and growing use on goods and passenger vehicles.

METALASTIK

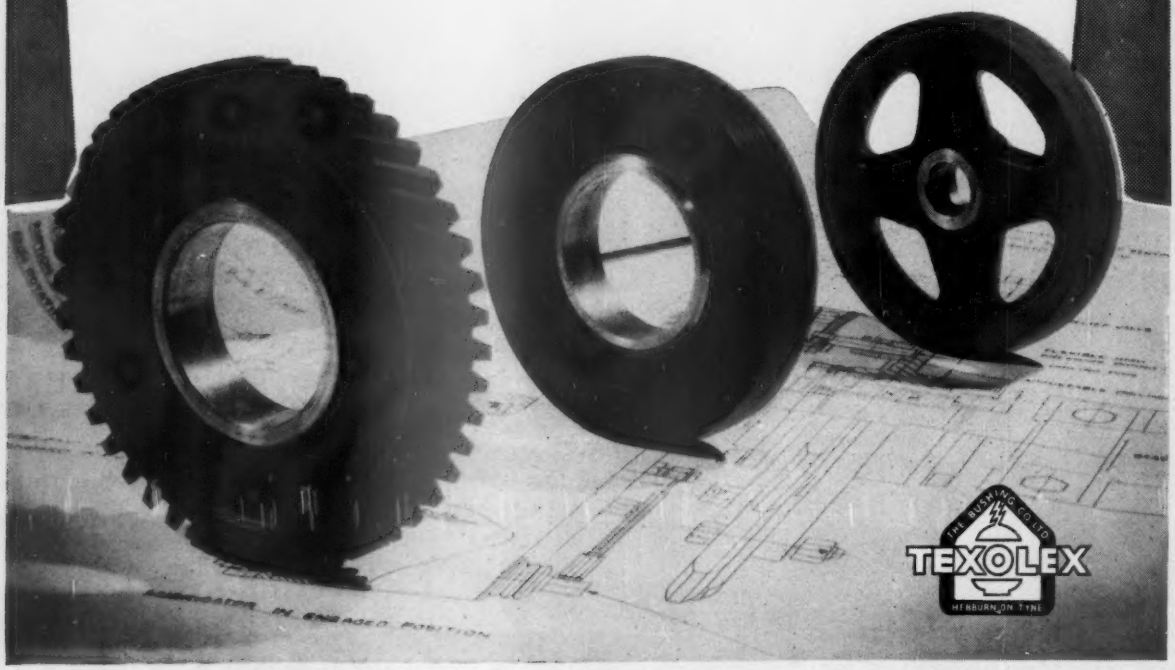
METALASTIK LTD., LEICESTER

# PLASTICS FOR THE ENGINEER

One of the many industrial applications of Texolex laminated mouldings is in the motor industry where extensive use is made of this material for cam gears. Some of the largest motor manufacturing organisations have found in Texolex many of the qualities of the ideal material, offering silence in operation, lightness in weight, high mechanical strength coupled with resistance to wear and corrosion.

## TEXOLEX IN THE AUTOMOBILE INDUSTRY

The Bushing Company Limited, would be pleased to give further technical information about Texolex laminated fabric gears and their suitability and operation in camshaft, jackshaft and oil pump drives.




THE BUSHING COMPANY LIMITED · HEBBURN ON TYNE · ENGLAND

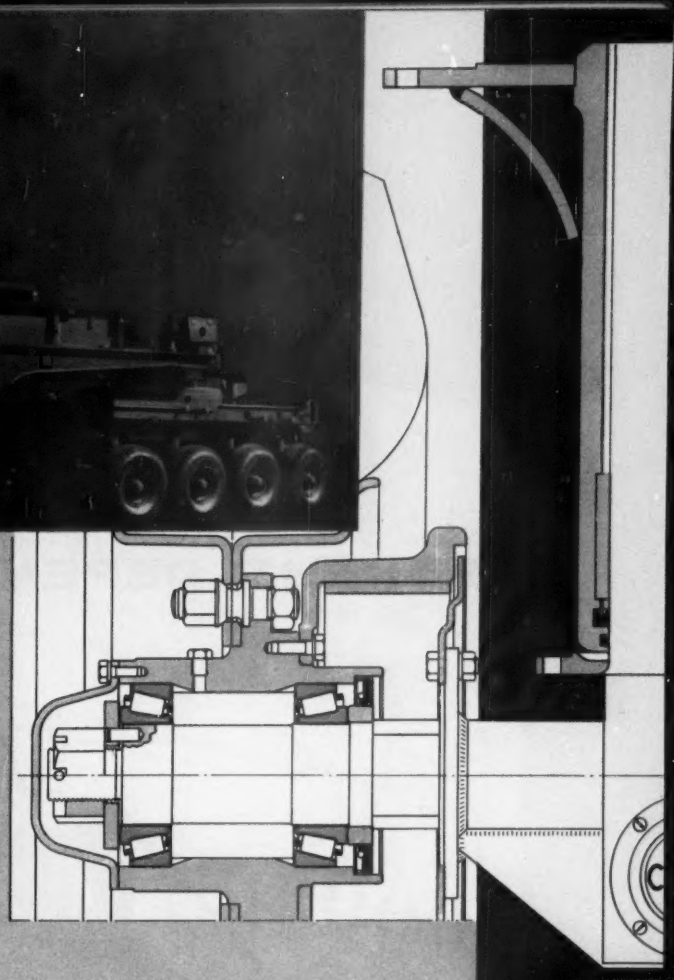
TELEPHONE: HEBBURN 32241 TELEGRAMS: "BUSHING, HEBBURN"

We're proud of our castings
are you?
We invite criticism of our castings as we believe that they are as perfect in specification and dimension as modern machinery and metallurgical control can supply them.
If your castings are not up to YOUR standard, perhaps we can help?
Precision grey iron castings, aluminium alloy sand castings, aluminium alloy gravity die and pressure die castings, zinc-based alloy pressure die castings.
West Yorkshire Foundries Ltd.
SAYNER LANE, LEEDS 10
Telephone: LEEDS 29466
London Office
HANOVER HOUSE, HANOVER SQ. W.1.
Telephone MAYfair 8561

Although designed primarily for the machining of light alloys, a wide range of speeds and feeds gives the ARCHDALE 18" VERTICAL remarkable scope on many other materials. A typical example of this versatility is seen at the Birmingham works of Stampings Alliance Ltd., where it is applied to good effect in sinking cavities in chrome—nickel—molybdenum die steel. There are 18 spindle speeds ranging from 18 to 2000 R.P.M. and 4 rates of longitudinal table feed for each speed. The spindle has rapid and fine vertical adjustment and the swivelling head machine gives up to 45° inclination each side of the vertical.

# ARCHDALE 18" VERTICAL MILLERS WITH FIXED OR SWIVEL HEAD..

JAMES ARCHDALE & CO. LTD. BIRMINGHAM 16
*A Member of the Staveley Coal & Iron Co. Ltd. Group.*
SOLE SELLING AGENTS: ALFRED HERBERT LTD., COVENTRY



# On a CRANE 32-wheeled trailer

The above illustration shows one of several special trailers ordered by the Department of Irrigation, South Africa.

These were designed by Cranes (Dereham) Ltd., Dereham, Norfolk, England, who also manufactured the bogies, the superimposed load-carrying portion being made by the Trailer Manufacturing Company Limited, Denver, Johannesburg. These vehicles have many interesting features, some designed to avoid difficulties latent in the road corrugations of 27 in. pitch.

Each bogie has 8 axles, each carrying two wheels and itself carried by a vertical hydraulic ram having 12" stroke: the eight cylinders are connected to equalize the loads on the axles. The hydraulic fluid, normally at a high pressure, can be released from the cylinders into a reservoir so as to lower the frame for loading purposes. The line drawing shows a part section of the hydraulic ram and cylinder, with one end of the axle: the wheels run on Timken tapered-roller bearings.

The maximum carrying capacity of the trailer is 90 tons; under South African conditions the payload is about 45 tons. The illustration below shows a test, carrying a tank.

**TIMKEN** Regd. Trade Mark: TIMKEN

***tapered-roller bearings***

**MADE IN ENGLAND BY BRITISH TIMKEN LTD**

DUSTON, NORTHAMPTON (Head Office); DAVENTRY AND BIRMINGHAM

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*SUBSIDIARY COMPANIES: FISCHER BEARINGS COMPANY LTD., WOLVERHAMPTON*
*TIMKEN-FISCHER STOCKISTS LTD., BIRMINGHAM*

# INHERENT DEPENDABILITY

## even under abnormal conditions

Operating anywhere, from monsoon country to under midnight suns Bedford have built themselves a reputation for ruggedness that takes a deal of living up to. The new 7-tonner is no exception to the rule, for, like its forerunners it relies on Hardy Spicer transmission equipment. The inherent dependability of Hardy Spicer transmission equipment is the product of long experience, constant development and the highest standards of engineering skill. That's why today precision built Hardy Spicer equipment is standard on Bedford and almost every other machine with really hard work to do.

# HARDY SPICER

**TRANSMISSION EQUIPMENT**

Inherent Dependability for the **BEDFORD 7-TONNER**

A Member of the **Birfield** Group

HARDY SPICER LIMITED, BIRCH ROAD

WITTON, BIRMINGHAM Birchfields 4504/9

# LANGITE

jointing material resists oils and spirits.

Used on practically every motor vehicle manufactured in this country; for more than 30 years it has also been used extensively by the electrical, oil, petroleum, aircraft and other industries.

**CORK MANUFACTURING COMPANY LTD.**, SOUTH CHINGFORD, LONDON, E.4
Telephone: Silverthorn 2666 (7 lines)

# *NEOLANGITE*

*A range of synthetic-rubber-bonded cork jointing materials, having the characteristic resilience of Langite but greater mechanical strength and recovery after compression. Used extensively on transformers, motor vehicles, aircraft etc.*

CHINGFORD CORK 'JOINTING' MATERIAL

For less critical applications, cost may be saved by the use of this material, made alongside Langite but to a less exacting specification.

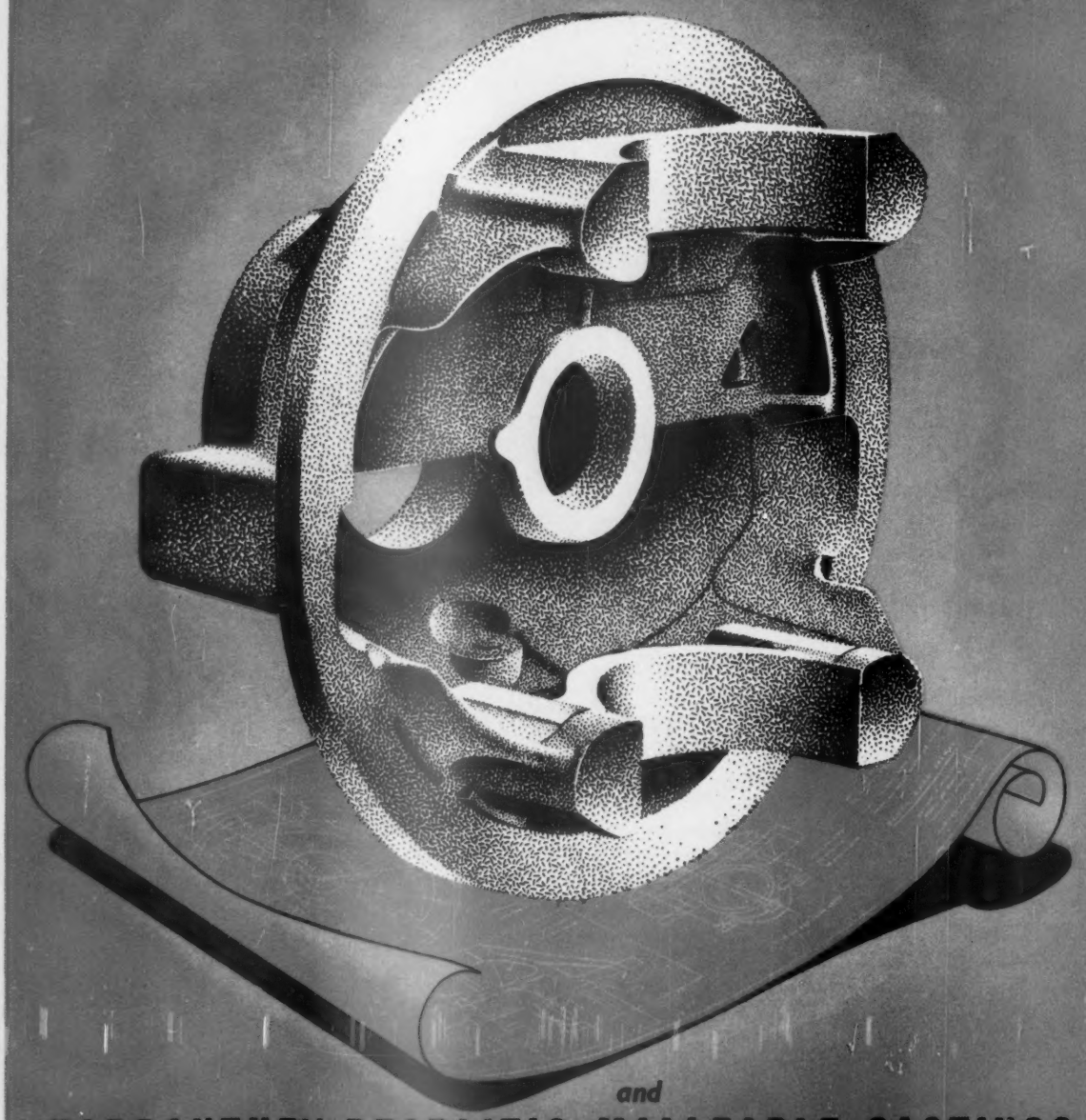
All other types of non-metallic seals, compressed asbestos fibre, impregnated paper etc. can be supplied.

# SHOTTON

For

## BETTER BLACKHEART MALLEABLE IRON CASTINGS

Backed by 60 years experience and technique



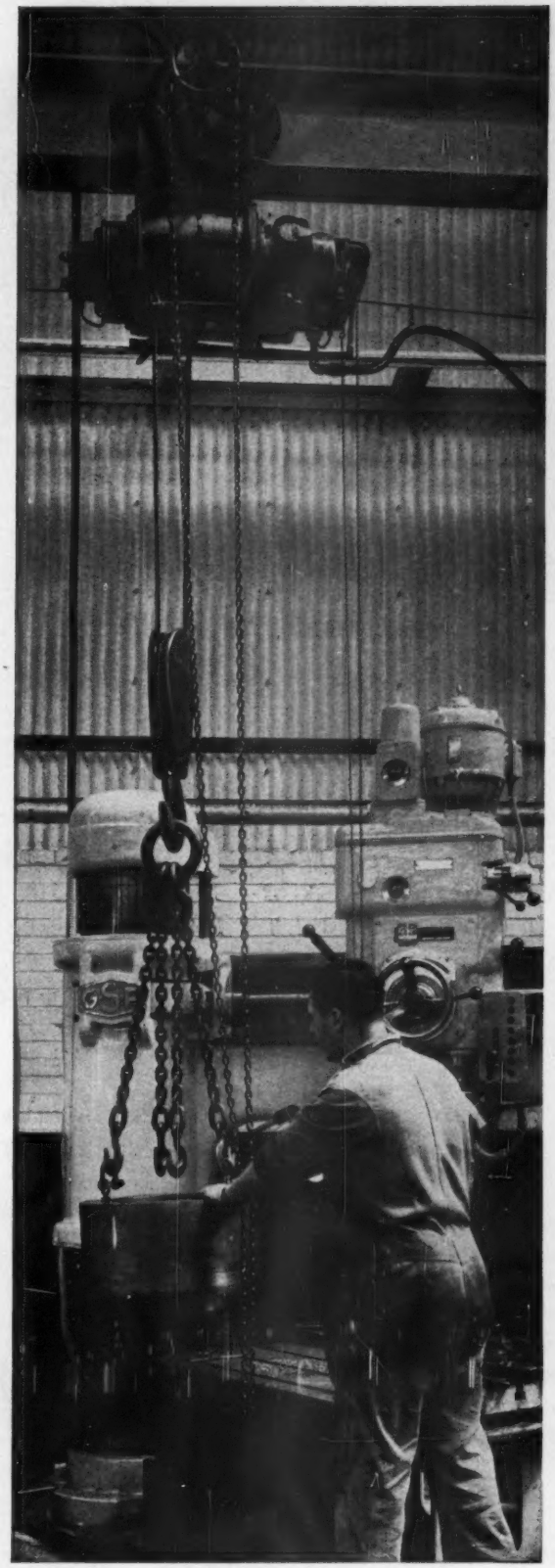
and

## "HARDANTUF" PEARLITIC MALLEABLE CASTINGS

SHOTTON BROS. LTD., OLDBURY Nr. BIRMINGHAM. Tel: BROadwell 1631-2

We are now booking capacity for our New Modern Foundry at Halesowen

# Twelve Atlas Copco Air Hoists do four years' precision work...



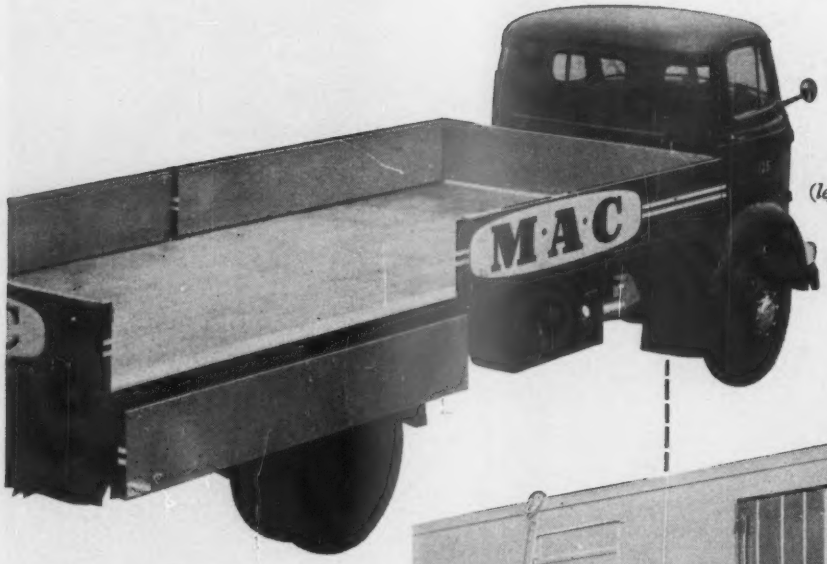
T22

without a single day's failure. Four years ago Briggs Motor Bodies, a Ford subsidiary company, installed twelve Atlas Copco air-hoists in their Southampton factory. They have proved a most worthwhile investment. Atlas Copco air-hoists are easily controlled at low speeds without costly additional mechanism; this means that heavy parts can be lowered accurately with the minimum of manhandling. And it saves a great deal of time where accurate placing is vital. Furthermore, the radial air piston air motor's low air consumption makes the hoist very economical in operation. Add to this the fact that in this factory not one of the twelve air-hoists has broken down in four years' constant use, and you will see the obvious advantages Atlas Copco can give you.

## World-wide sales and service

The Atlas Copco Group puts compressed air to work for the world. It is the largest group of companies specialising in the development and manufacture of compressed air equipment. It embraces Atlas Copco companies or agents manufacturing or selling and servicing Atlas Copco equipment in ninety countries throughout the world. For further details of the equipment featured here, contact your local Atlas Copco Company or Agent. If you have any difficulty, please write to:—Atlas Copco AB, Stockholm 1, Sweden, or Atlas Copco (Great Britain) Ltd, Beresford Avenue, Wembley, Middlesex.

**Atlas Copco** *Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment*




*(left) Dropside truck with* Timinium *body for Metal Agencies Ltd.*
**Bodywork by Bonallack Ltd.**
*(below)* Timinium *container for Chieftain Yeast Ltd.*

## an open and shut case

The case for *Timinium* in the construction of vehicle bodywork is strong indeed. *Timinium* bodies are strong and very long lasting. They are painted solely for appearances: in fact, they need no surface protection whatsoever. Above all, they are light, saving up to 50% on bodyweight and enabling correspondingly heavier payloads to be carried. And the lighter the body, the less the tax. For higher payloads and lower overall costs, think in terms of *Timinium.*

# TIMINIUM

***TI ALUMINIUM LTD.*** ONE OF THE LARGEST U.K. MANUFACTURERS OF SHEET, CORRUGATED SHEET, STRIP, CIRCLES, PLATE, EXTRUDED SECTIONS AND TUBES — IN THE TIMINIUM RANGE OF ALUMINIUM AND ALUMINIUM ALLOYS.

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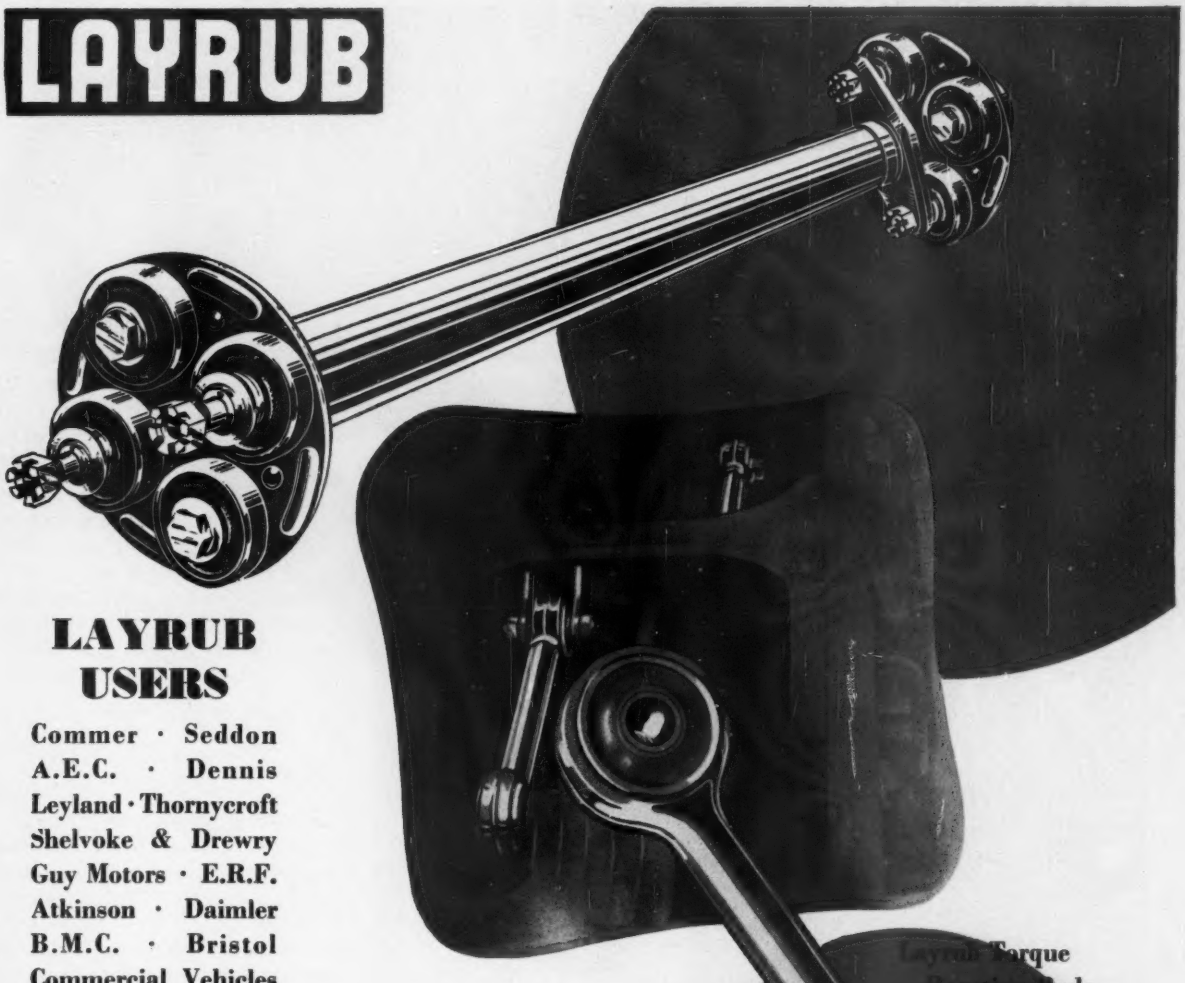
# LAYRUB



Layrub Torque Reaction Rods

## LAYRUB USERS

**Commer · Seddon**
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**Guy Motors · E.R.F.**
**Atkinson · Daimler**
**B.M.C. · Bristol**
**Commercial Vehicles**

Layrub Resilient Clutch Centre

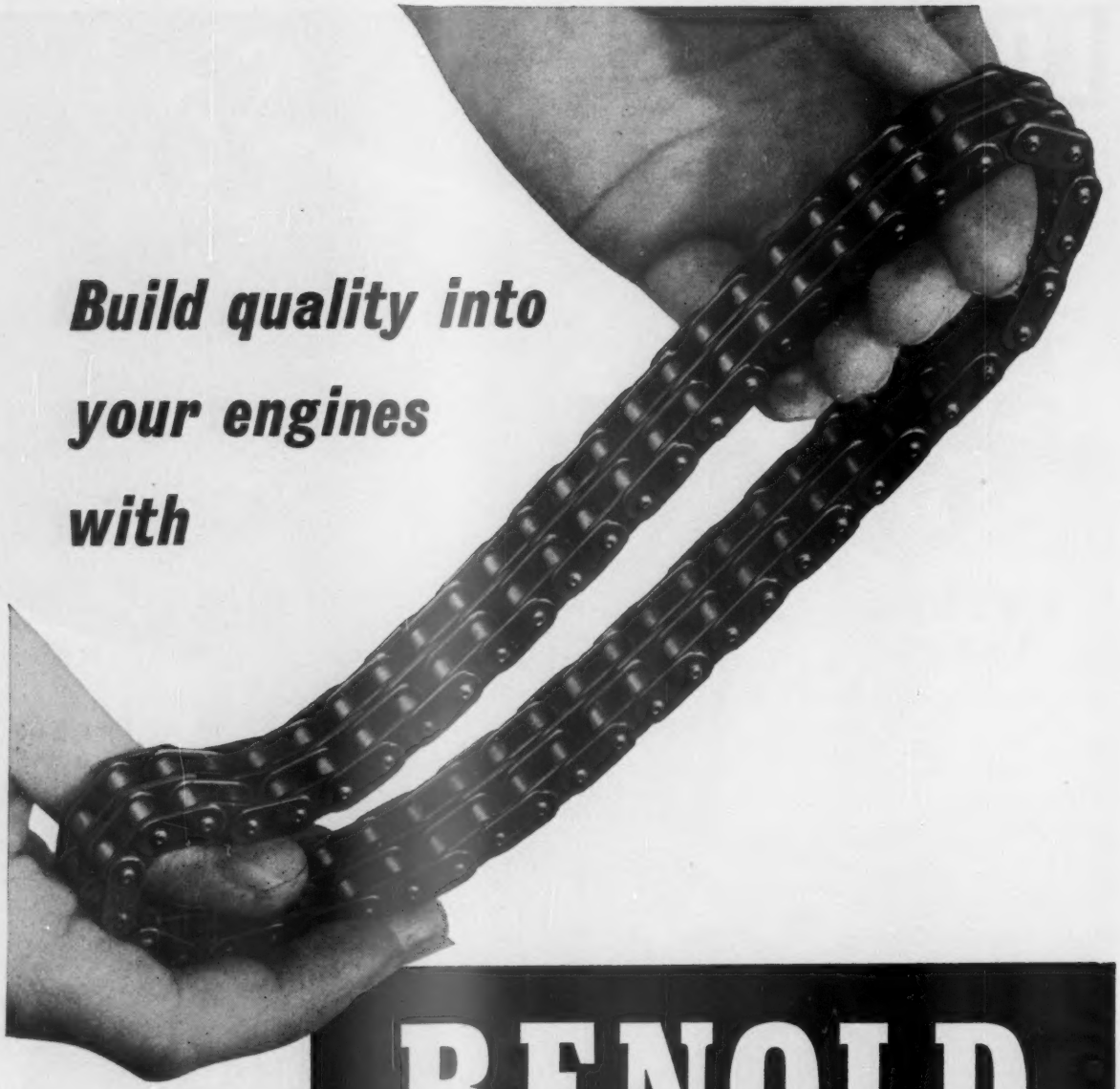
**Layrub is the first thought of the wise designer when transmission questions arise. It is uncomplaining and keeps on going when others have given up the struggle. Its rubber-bush cushioned drive plus the fact that it requires no lubrication, are just two reasons why you'll find Layrub Transmission on practically all makes of Commercial Vehicles.**

**The Torque Rods and Clutch Centres have also won themselves a place for reliability and long life.**

**Write us for full technical information.**

**LAYCOCK ENGINEERING LTD.**
**MILLHOUSES,**
**SHEFFIELD, 8**

A Reyrolle Company



*Build quality into your engines with*

# RENOLD

## TIMING CHAINS

RENOLD—*the FIRST name in precision chain*

RENOLD CHAINS LIMITED MANCHESTER

# NEW ANDRE AIR SPRINGS FOR COMMERCIAL AND PASSENGER VEHICLES

The Andre Air Spring consists of two simply installed Air Pillows, one each side of the vehicle, whether single or tandem axle arrangement, but they can also be fitted in wishbone suspension arrangements or independent trailing arm suspensions. The pressure is maintained in the Pillows from the vehicle air brake system, or from a separate compressor when air brakes are not fitted. The suspension assembly can be arranged with rubber bushing so as to eliminate all lubricating points.

## AUTOMATIC LEVELLING

A suspension incorporating Andre Air Springs and levelling valves assures that the floor of the vehicle is always parallel to the axle, thus uneven loading and severe crown road conditions etc. are overcome, giving a more pleasant and easy ride for the driver. For Passenger Vehicles step heights remain constant irrespective of load.

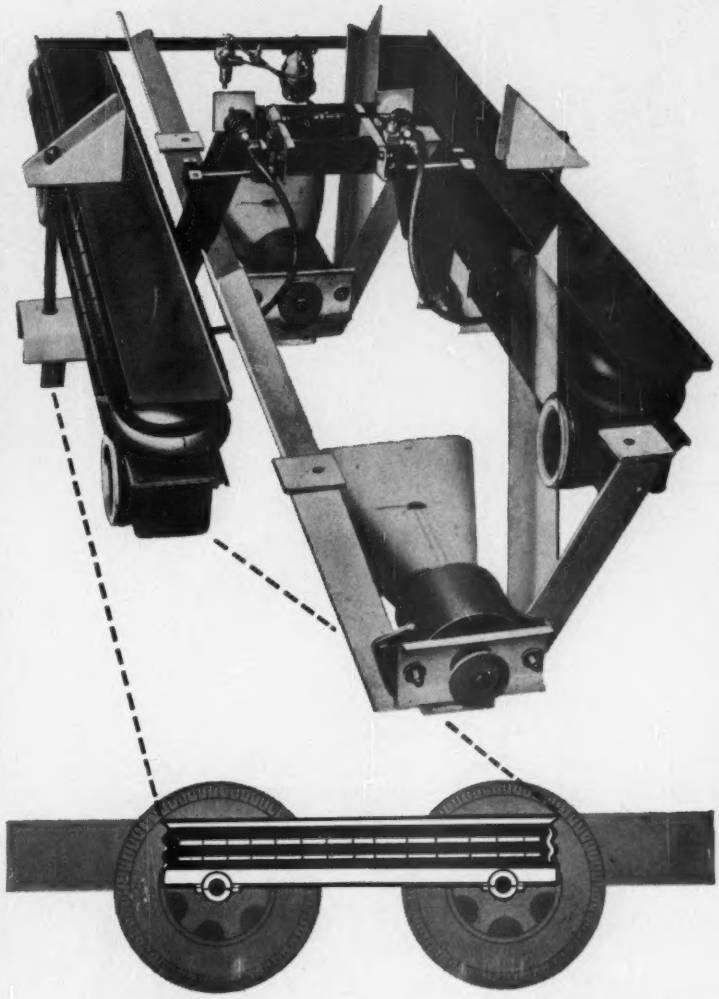
## ALWAYS THE SAME RIDE WHETHER LIGHT OR LADEN VEHICLE

A feature of air springing is that, due to the action of the levelling valves, the position on the load deflection graph remains constant irrespective of load; consequently the frequency remains the same for all conditions of service. This also has the effect of eliminating bouncing due to resonance conditions, thus reducing maintenance not only of the suspension but chassis and body. It also affords greater protection for the goods or passengers being carried.

## INCREASED SAFETY

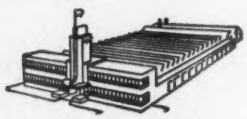
This ideal suspension gives greater tyre life.

**We invite you to approach us with your problems, when we shall be pleased to co-operate with you on all technical matters appertaining to this great new advance in suspension systems.**



ANDRE RUBBER

Three-and-a-half acres of specialised Rubber Technology.



TAB/AR.122

**ANDRE RUBBER COMPANY LIMITED**

KINGSTON BY-PASS, SURBITON, SURREY

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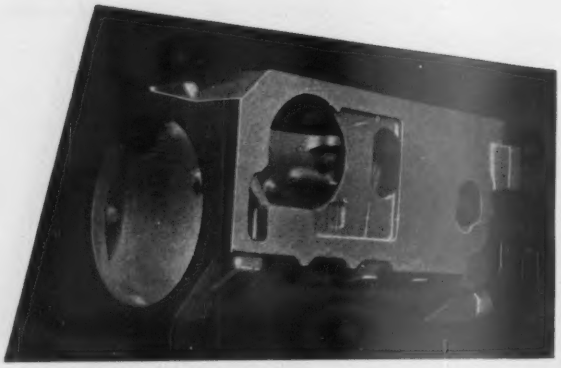
**(A SILENTBLOC COMPANY)**

# Darcast keeps pace with Progress

The Control and Technique
developed for the production of
High Duty Iron Castings
by the Darcast Foundries
is ready to meet developments
of the Motor Industry.



AUTOMATIC GEARBOX CASE *(COURTESY OF ROLLS-ROYCE LTD)*

BRAKE DISC *(COURTESY OF DUNLOP RIM & WHEEL CO LTD)*

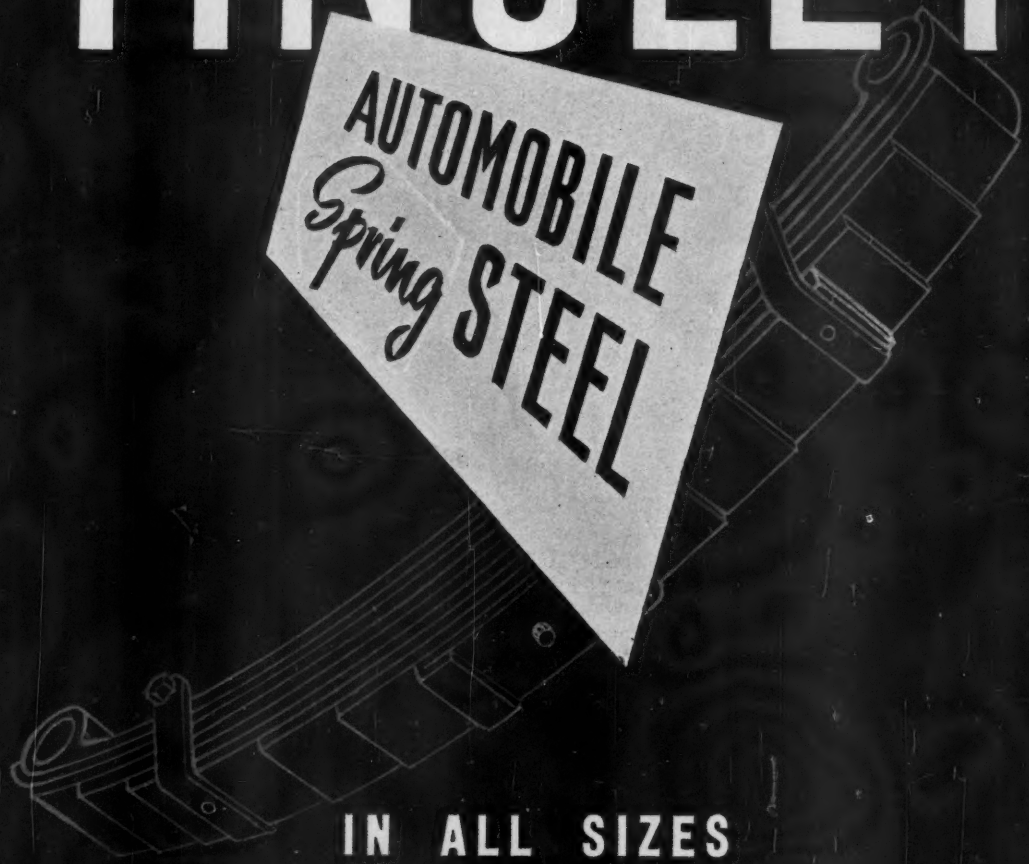
COMPOSITE STEEL & CAST IRON BRAKE DRUM
*(COURTESY OF VAUXHALL MOTORS LTD)*

DARCAST

**DARTMOUTH AUTO CASTINGS LIMITED**
*SPECIALISTS IN HIGH DUTY IRON CASTINGS FOR THE MOTOR INDUSTRY*

**SMETHWICK 40**
**BIRMINGHAM**

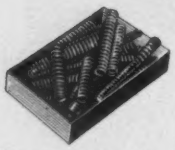
# TINSLEY



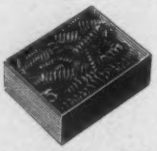

IN ALL SIZES
& QUALITIES

THE TINSLEY ROLLING MILLS CO LTD
*Established 1846*
PHONE SHEFFIELD 41171 TINSLEY SHEFFIELD GRAMS BEVELSTINSLEY

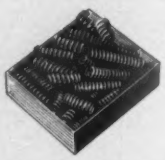
# What sorts of springs do you need?



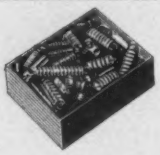
**No. 760.** 3 doz. Assorted Light Compression Springs. 1″ to 4″ long, 22 to 18 S.W.G., ¼″ to ½″ diam. 6/6 each.



**No. 757.** Extra Light Compression, 1 gross Assorted, ½″ to ⅝″, ¼″ to 2″ long, 27 to 20 S.W.G. 15/- each.



**No. 98A.** 3 doz. Assorted 1″ to 4″ long, ½″ to ¾″ diam., 19G to 15G. 5/6 each.



**No. 758.** Fine Expansion Springs. 1 gross Assorted ½″ to ⅝″, ¼″ to 2″ long, 27 to 20 S.W.G. 15/- each.

**No. 388.** ½ gross Assorted Small Expansion Springs. ⅜″ to 1½″, 18G to 21G. 9/6 each.

Compression? Expansion? Long? Short? Light? Heavy? Let Terry's BOXES OF ASSORTED SPRINGS settle the question. Just the job for you experimental people—a simply unlimited assortment from our tremendous range of springs of every variety. The 9 boxes shown here are only a few—but why not let us send you a full list—post free.

# TERRY'S

## ASSORTED SPRINGS

HERBERT TERRY & SONS LIMITED · REDDITCH · WORCS

*(Makers of quality Springs, Wireforms and Presswork for over a century)*

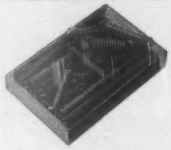
* Interested in Springs 1957 Edition of "Spring Design and Calculations"—post free 12/6d.

**Cut production costs with Terry Wire CIRCLIPS**

*(Square Section)*

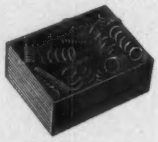
We can supply from stock in sizes from ⅛″ to ½″.

**No. 466.** ½ gross Assorted Small Expansion Springs ⅜″ to 1½″ long, 3/32″ to 3/16″ diam., 21G to 24G. 6/6 each.



**No. 753.** 3 doz. Assorted Light Expansion ½″ to ½″ diam., 2″ to 6″ long, 22 to 18 S.W.G. 10/6 each.

**No. 1024.** 20 Compression Springs 12″ long. ½″ to ½″ diam., 24G to 18G, suitable for cutting into shorter lengths; and 30 Expansions 1½″ to 12″ long, 5/32″ to ⅜″ diam., 22G to 16G. 24/- each.



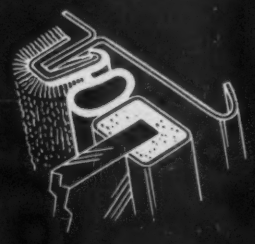
**No. 1013.** 1 gross Small Coil Compression Springs, ½″ to 1½″ long, 3/32″ to 7/16″ diam., 24G to 19G. 6/- each.

HT31

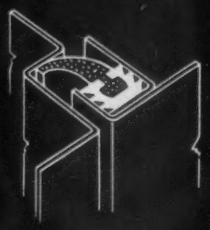
TRADE MARK

# BRIGHT PATENT DOOR SEALS

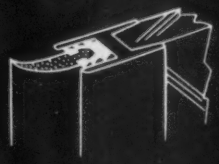
## MOULDINGS & BEADINGS



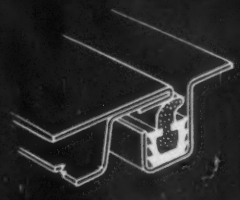
INNER SEAL



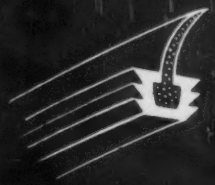
OUTER DOOR SEAL



QUARTER WINDOW SEAL



BOOT SEAL



CHANNEL SEAL

### "SNAPPON" CT TYPE

- ★ SELF SECURED
- ★ NO CLIPS
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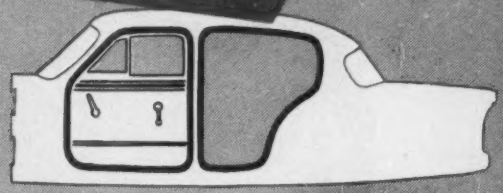

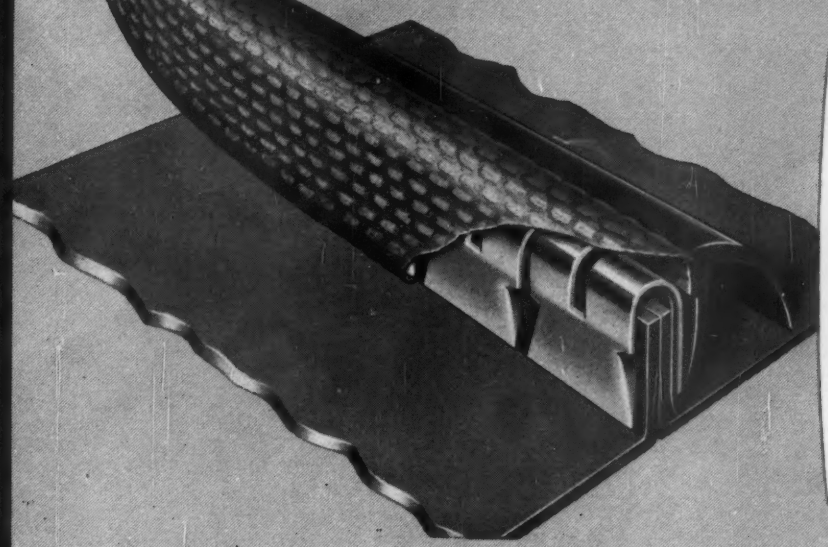

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| 702,743 | 34,064/55 |
| 655,299 | 36,674/55 |
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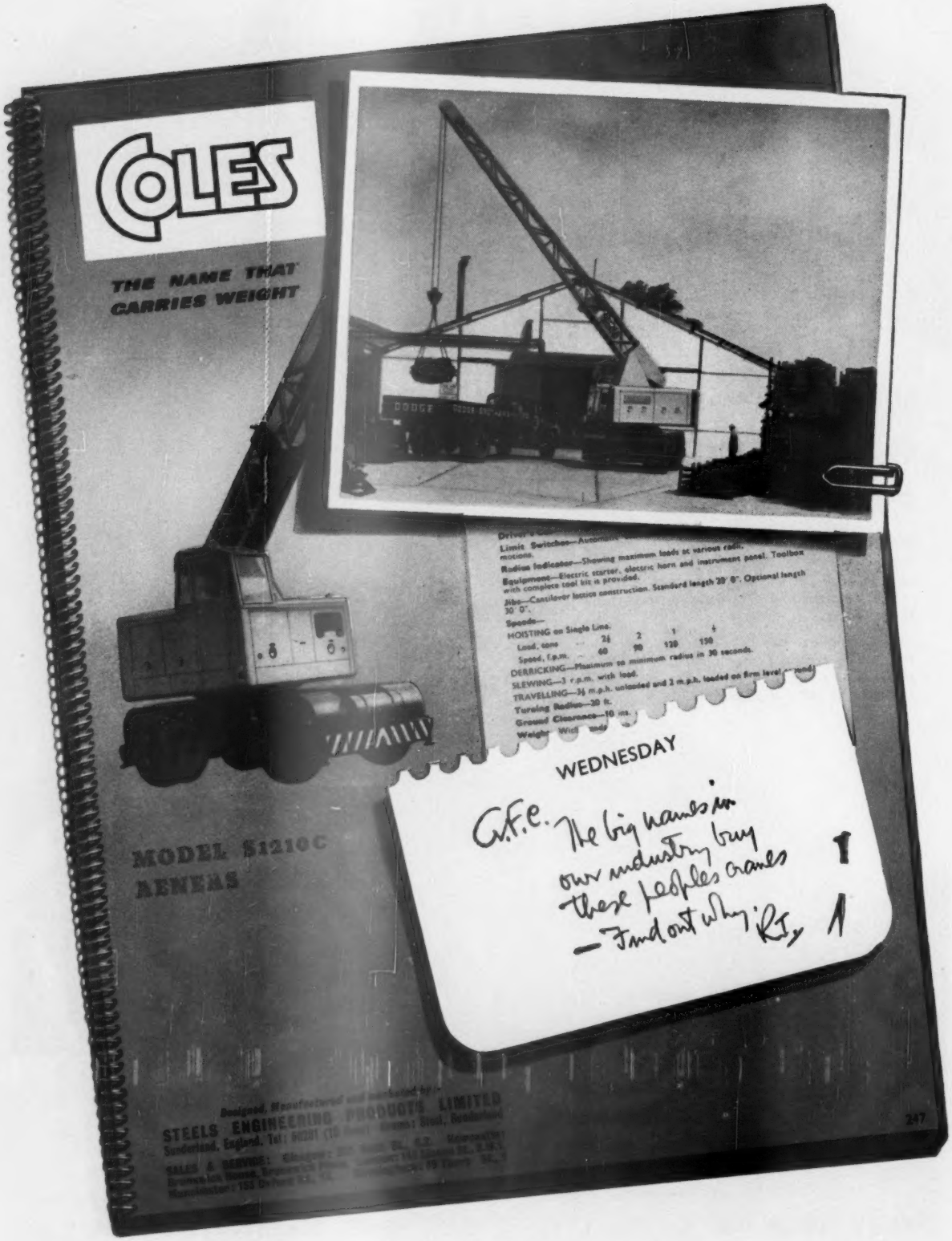
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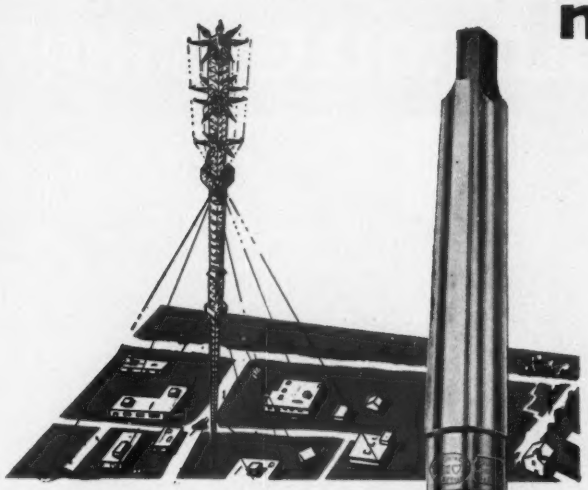

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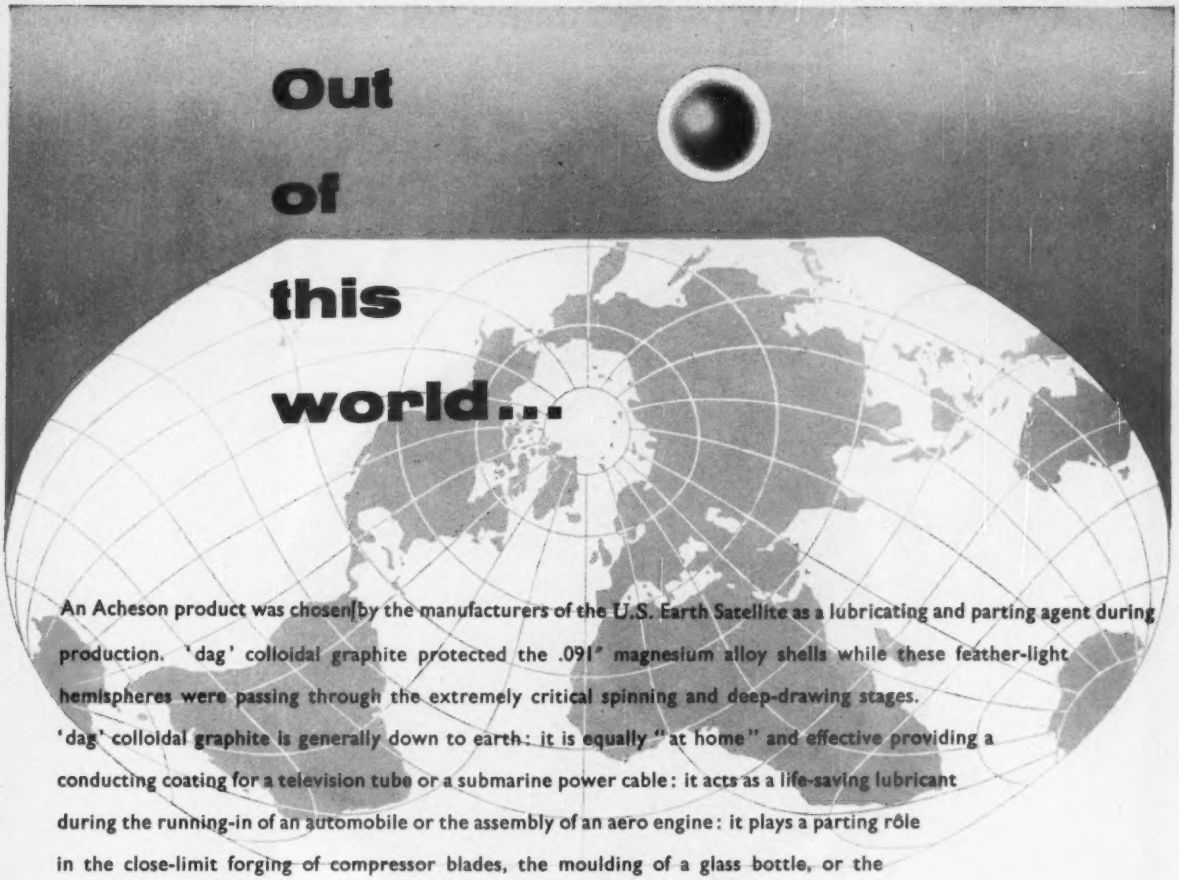

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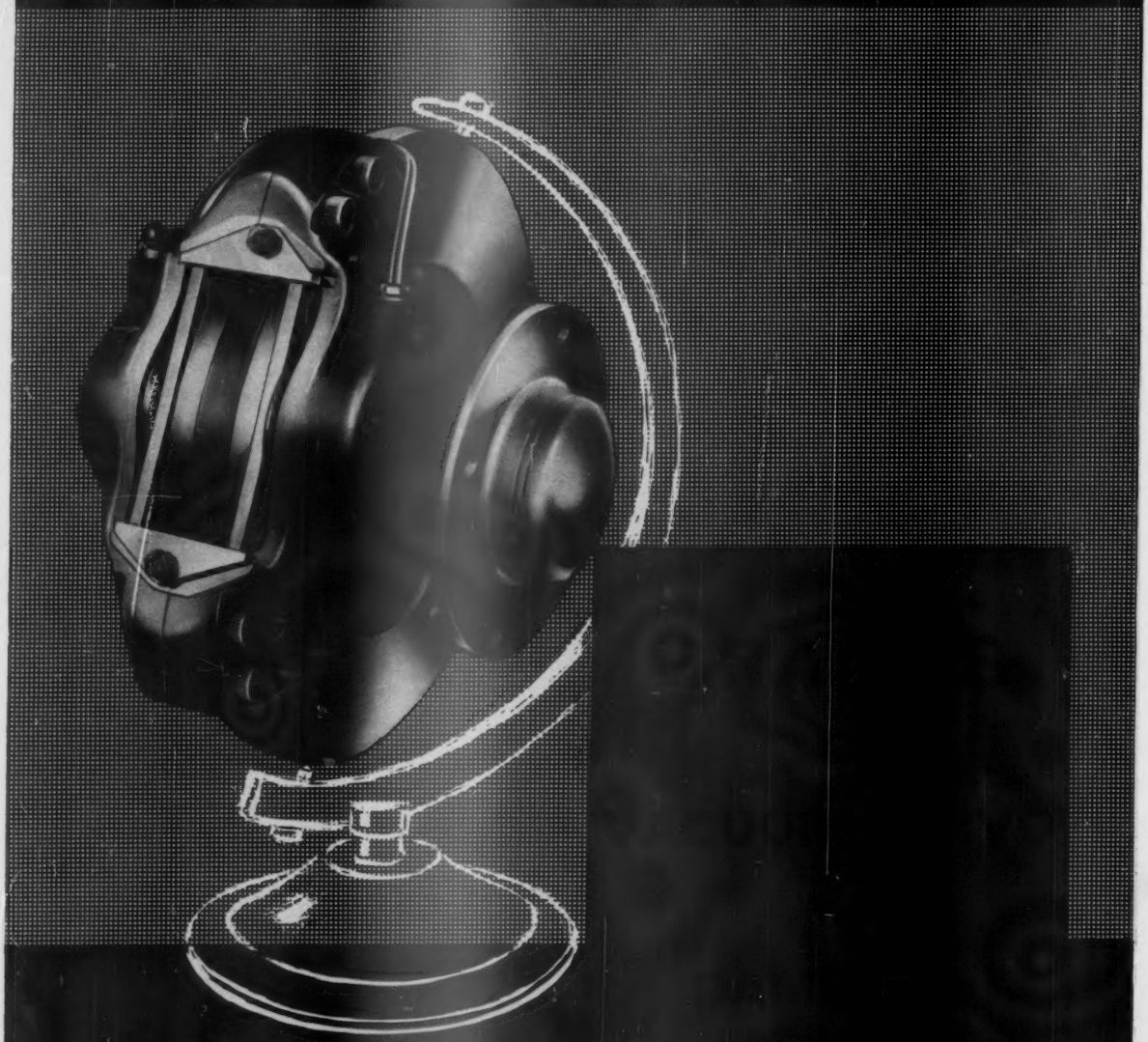

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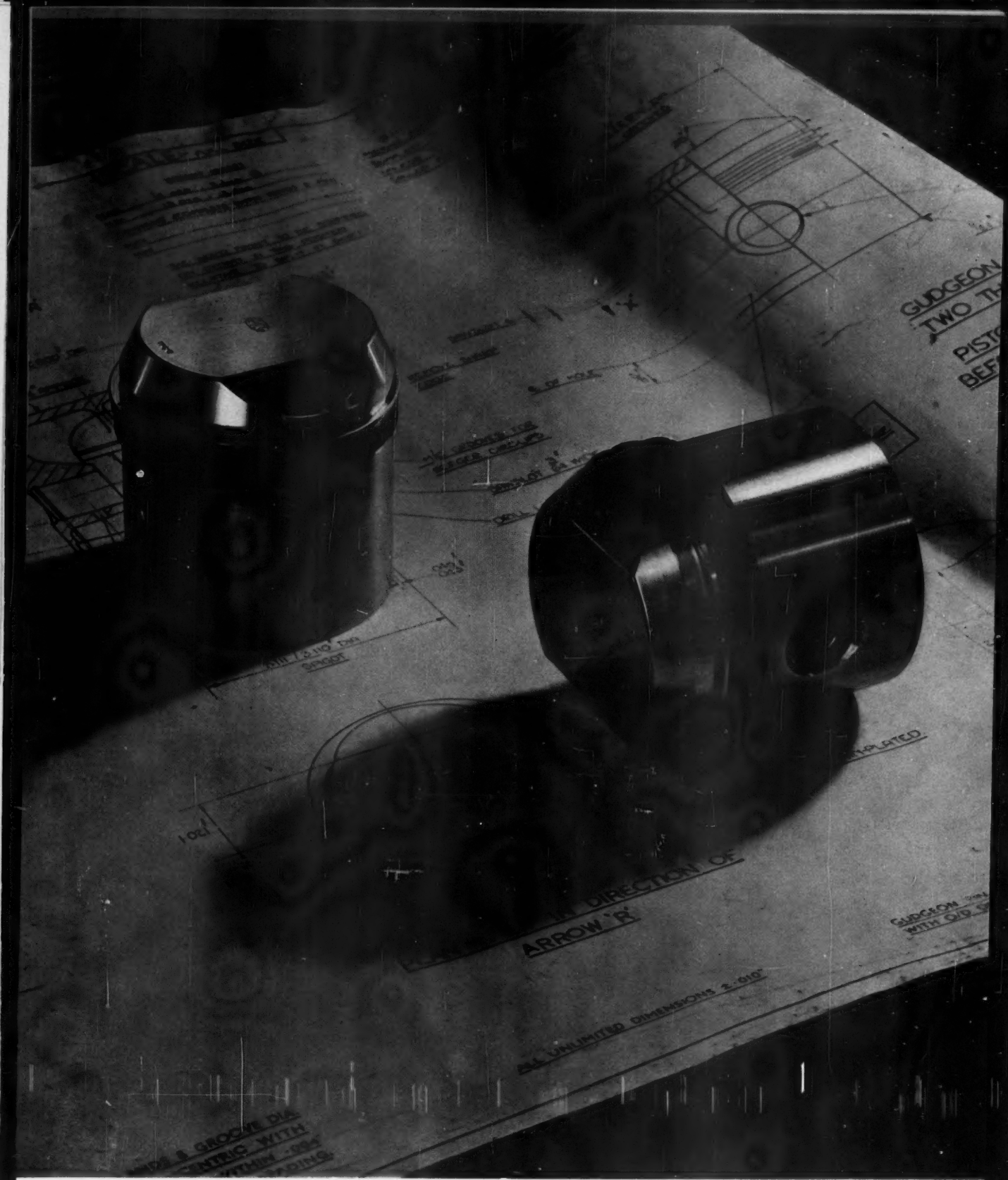


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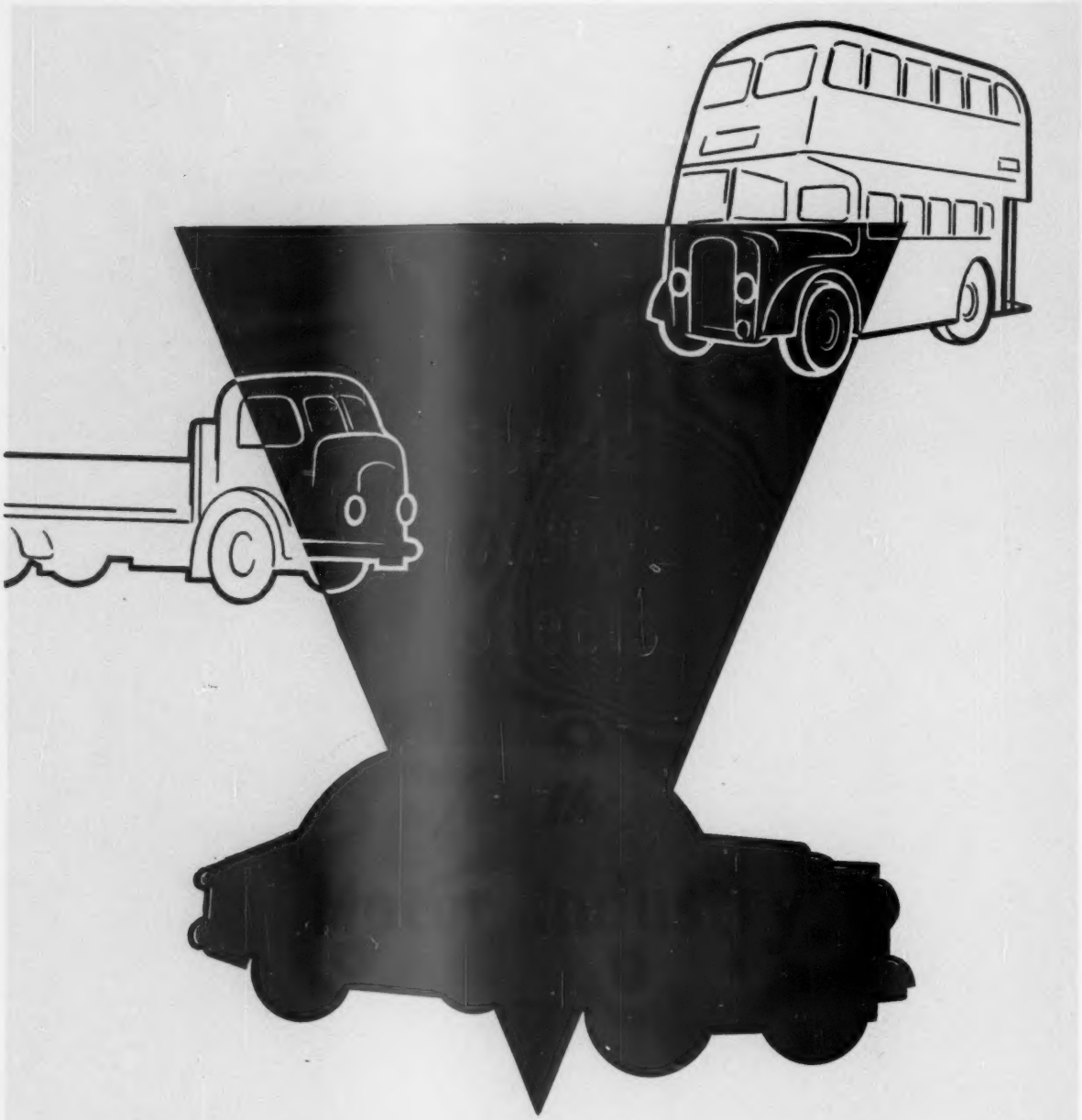

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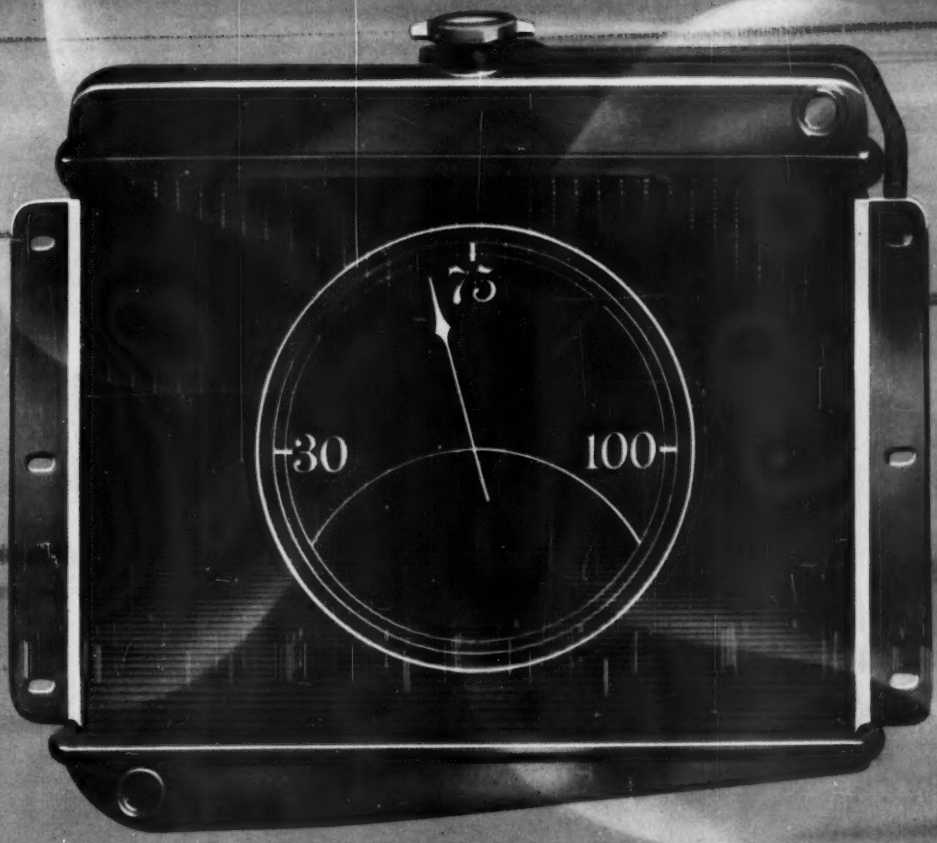


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# AUTOMOBILE ENGINEER

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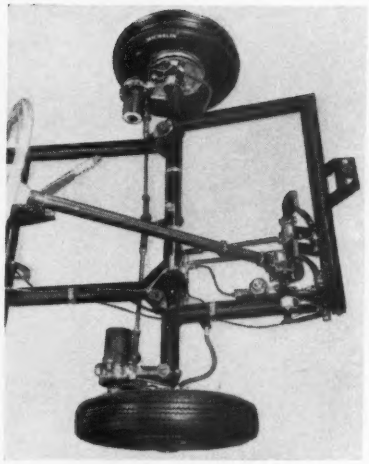

FRONT SUSPENSION AND STEERING LAY-OUT ON THE MEADOWS FRISKY, A NEW MINIATURE CAR THAT WAS EXHIBITED AT THE LONDON SHOW THIS YEAR


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DESIGN MATERIALS **AUTOMOBILE ENGINEER** PRODUCTION METHODS WORKS EQUIPMENT

# Thoughts on the Show

WHILE the Earls Court Motor Show continues to appeal strongly to the general public, it has lost some of its interest for those who are chiefly concerned with technical developments. No longer is the Show the great occasion for the introduction of new models. The present policy of every manufacturer is, of course, to introduce a new model at the most appropriate moment, which may be months before the Show. The result of this is that the model may have been fully described and may be very well-known before the Show begins. This practice does take away some of the sense of anticipation that characterized the approach of pre-war exhibitions, but it is one to be commended.

Apart from the number of miniature cars, of which the completely British Frisky roused by far the greatest interest, the exhibits this year showed little significant change from those of 1956. Modifications to established designs there were in plenty, but little new ground was broken. In fact, except for transmissions it is not too much to say that, for the immediate future at least, design is frozen in a pattern that has now been followed for several years. This, of course, is understandable, since tooling costs are now so great that radical design changes can be accepted only for the most compelling reasons.

Although there was no major departure from traditional design and practice, certain trends first seen in 1956 were much more strongly marked. For example, two-pedal control, if not fully automatic transmission, has been adapted for the cheaper cars much more quickly than was generally expected. In fact, only Vauxhall Motors of the major manufacturers in this country did not offer two-pedal control in one form or another.

Engine design showed no outstanding developments. Efficiencies continue to rise, but the improvement curve is flattening out and it would appear that the carburetted piston engine is approaching its peak efficiency. The adoption of petrol injection might lead to a marked improvement in engine performance—not all engineers are of this opinion—but all the present evidence suggests that solely on cost grounds petrol injection can as yet be considered only for the more expensive vehicles.

Generally, the models introduced since the 1956 Exhibition have higher maximum speeds than the models they replace. Because of this, braking has necessarily been most carefully considered. Improved braking has not, however, been effected by substituting disc brakes for drum brakes. Instead, it has been generally obtained by fitting drum brakes with a considerably greater friction area. In view of the proven efficiency of disc brakes, the small use that is made of them may cause some surprise. Once again the reason is, in part at least, economic, and until the first cost of fitting disc brakes can be brought much closer to that for drum brakes, their use will be confined to a relatively small number of cars.

In general, suspension systems showed little change. One American car, a Cadillac, had a pneumatic suspension, and since several British accessory makers have developed systems of this kind, it is almost certain that in the near future British cars will be available with pneumatic suspension. This is an excellent prospect. Pneumatic suspension will not only improve ride comfort, but should also relieve the chassis of many strains and stresses, perhaps of dangerous magnitude, in vehicles used on poor roads. This can be particularly important for export markets, because, despite the much publicized deficiencies of the British road system, surfaces in this country are generally better than those met abroad, and suspension weaknesses in British cars have been a source of damaging criticism from overseas users.

Body styling followed well-established lines. It was evident that body stylists and designers are now much more conversant with the special problems inherent in integral construction, particularly those of stress distribution. The latest body shells are surprisingly stiff, despite their very light construction.

If the exhibits are used as criteria for measuring public taste, the monotone body and upholstery find little favour. Many of the two colour paint finishes looked most attractive under show conditions, but some would probably soon lose their appeal under working conditions. It is obvious that the automobile industry must now pay as much attention to eye-appeal as to engineering quality.

Although this could not, by any stretch of imagination, be described as an exciting show, it was an encouraging one. The British cars generally compared favourably with Continental models in the equivalent basic price range. This augurs well for export markets in the immediate future, but is not grounds for complacency, particularly if the industry is called upon to face a European common market and consequent keener competition even at home.

# LONDON SHOW REVIEW

## *Engines*

*The Trend Towards Higher Compression Ratios is Less Marked This Year. Rationalization of Design Continues*

THERE are only detail modifications to report on engines manufactured by the big British companies, but the policy of rationalization with regard to engine types has become increasingly noticeable. The new features introduced this year were to be found mainly in engines exhibited by the smaller companies, in foreign exhibits, and in the ever-widening range of miniature cars.

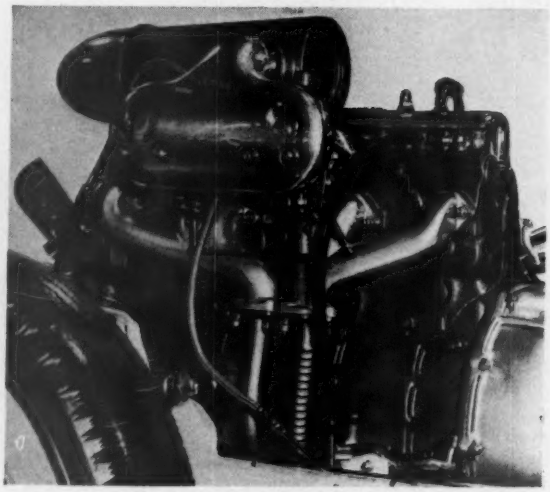
Lead-indium plated bearings, used in conjunction with full-flow oil filters are employed by the British Motor Corporation, but white metal is still favoured by most of the other large companies. It appears that white metal, with its superior anti-frictional properties and conformability, is capable of withstanding the higher bearing pressures encountered with the employment of increased ratios, provided that particular care is taken to keep the lubricating oil in a clean condition. Even with dirty oil, the white metal type bearings have considerable advantages, so far as embeddability is concerned.

The Glacier Metal Co. Ltd. exhibited a 2 in diameter white metal bearing that has run for a considerable period at 1,500 r.p.m. under a bearing pressure of 6,000 lb/in², which is more than double the normal design pressure. The same company has introduced a steel-backed bearing, lined with an aluminium alloy with a high tin content, for use in big ends and main journals subject to heavy loads. It is claimed that this alloy has a composite metallurgical structure combining a softer matrix with a higher fatigue strength than any previous alloy, the claim being based on experience gained with a large programme of routine testing of vehicles in regular service.

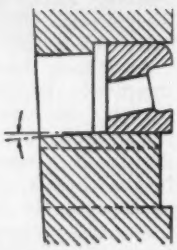
Two new piston rings are announced. One is the Hepolite oil control ring, which comprises four components. These include the upper and lower thin rail sections, chromium plated on the face in contact with the cylinder; the rails are separated by a cast iron spacer with drainage slots, together with a spring expander. It is claimed that this assembly provides adequate oil control in both directions of piston motion and also that it has a long life.

Specialloid Ltd. exhibited their new Inertia-Flow oil control ring, which differs substantially from the orthodox type of slotted ring. It has been developed to meet the requirements that have arisen because of the modern trends toward higher engine speeds, the employment of connecting rods with short centre-to-centre lengths and of pistons of relatively small overall length. In these new engines, orthodox types of slotted oil control rings in some instances are inadequate to cope with the large quantities of oil that are flung into the bores.

The Inertia-Flow ring not only has an efficient two-way scraping action, but also takes advantage of the inertia forces that act on the oil droplets during the upward motion of the piston. Thus, the maximum scavenging action is obtained during the upward instead of the downward strokes. As the piston moves up towards top dead centre, oil scraped from the cylinder wall is forced through the drain holes in the base of the groove round the periphery of the ring, and thence through the holes drilled radially through the piston, adjacent to the lower wall of the groove in which the ring is housed.



*Above: The B.M.C. Series C engine installed in the Riley Two-Point-Six develops 101 b.h.p.*



*Right: An advantage of the Specialloid Inertia-Flow oil control ring is that it does not rely on extremely high radial loading*

From the illustration of the ring, it can be seen that the groove round its periphery is machined at an angle, in such a way that it not only takes advantage of the inertia effect to clear the oil away rapidly, but also the upper edge of the lower land forms an efficient scraper to scoop oil off the bore when the piston is moving upwards. The oil drainage holes in the ring are also inclined in the same sense, and they are flush with the lower edge of the groove so that it is drained completely. To allow the oil to pass the top land, the upper edge of this land is radiused and chamfered so that there is no upward scraping action.

An advantage of this ring is that it does not rely on ex-extremely high radial loading for its effectiveness. It follows that the mechanical efficiency of the engine is improved, and the rate of wear both on the ring and in the bore is reduced. This wear reduction is assisted by the fact that the ring has a generous peripheral bearing area and the chamfered upper edge gives rise to a Michel effect. Special attention has been paid to all these features to ensure that the proportions in relation to the radial load are not such as

to lead to over-scraping and inadequate lubrication.

Another advantage of the Inertia-Flow ring is that its cross section is substantially uniform by comparison with that of more conventional rings with about eight slots in their grooves. The substitution of multiple drillings for milled slots eliminates uneven stressing, and fully effective bedding-in is obtained in a relatively short time.

With regard to the latest trends in engine design, the rise in compression ratios apparent in recent years, in general, has not continued this year, except in those engines that previously employed a ratio less than 8 or 8·5:1. In fact, where a rationalized engine is employed in a comparatively light chassis, one way of derating the power unit is by reducing the compression ratio. This year's trends are more towards improvement in volumetric efficiency, obtained by using separate inlet ports, smoother manifold passages, and larger valves.

There are no signs of any further reductions in piston speeds. In general, the bores of engines of 1,000 cm³, or less, are still smaller than the strokes. The B.M.C. and Standard units in this class both have a stroke of 76 mm. At 5,000 r.p.m., this gives a mean piston speed of 2,500 ft/min. An advantage of the small bore for four-cylinder, in-line engines is that they can be made relatively compact so far as overall length is concerned. With engines of the larger capacities, bores cannot be further increased without adding unduly to the size of the engine, so the number of cylinders tends to be increased. Even so, one large 6·4 litre V-eight engine of American design has a stroke of 99 mm; this gives a mean piston speed of 2,920 ft/min at 4,500 r.p.m., the speed at which maximum power is obtained.

**British Motor Corporation**

The Series A, 948 cm³ engine continues unaltered, and is fitted to the Austin A35 and Morris Minor vehicles. The Series B, 1,498 cm³ engine, with an 8·3:1 compression ratio, is fitted to the Austin A55 introduced in February. Fitted with a Zenith carburettor, this engine has an output of 51 b.h.p. at 4,250 r.p.m., and a torque of 81 lb-ft at 2,000 r.p.m. A similar engine, with a 7·2:1 compression ratio is used in the Metropolitan, and this provides 47 b.h.p. at 4,100 r.p.m.

The Series B engine used in the Morris Cowley and Oxford and the Wolseley Fifteen-Fifty is fitted with an S.U. semi-downdraught carburettor, and has a compression ratio of 8·3:1. Its output is 55 b.h.p. at 4,400 r.p.m., and the maximum torque is 78 lb-ft at 2,400 r.p.m. The new Wolseley Fifteen Hundred is powered by the same engine, but with a compression ratio of 7·2:1 giving 50 b.h.p. at 4,200 r.p.m.

In the M.G. Magnette, the Series B engine is fitted with two S.U. carburettors and a modified camshaft, and provides 68 b.h.p. at 5,200 r.p.m. The M.G. A, which has the same engine, fitted with twin S.U., semi-downdraught carburettors develops 72 b.h.p. at 5,500 r.p.m.

Another example of multiple application of one basic engine is the Series C, six-cylinder engine, of 2,639 cm³ swept volume. This unit is basically unchanged this year. The version used in the Austin A95 has a Zenith carburettor, and its output is 92 b.h.p. at 4,500 r.p.m., the maximum torque being 130 lb-ft at 2,000 r.p.m. The Morris Isis engine, with a single S.U. carburettor, is rated at 90 b.h.p. at 4,500 r.p.m. and gives 124 lb-ft torque at 2,000 r.p.m. A twin S.U. version, used in the Austin A105 and the Austin-Healey 100-Six with the same compression ratio of 8·3:1, has an output of 102 b.h.p. at 4,600 r.p.m.; while a similar engine in the Wolseley Six-Ninety is rated at 97 b.h.p. at 4,500 r.p.m.

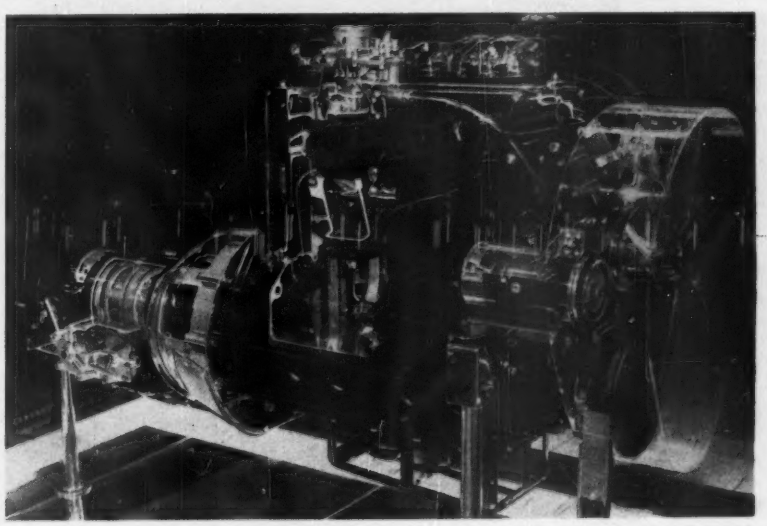
The Riley 2½ litre vehicle with its four-cylinder engine is now superseded by the Riley Two-Point-Six saloon, with a C Series engine. This version of the engine is fitted with two S.U., H.4 carburettors. It is rated at 101 b.h.p. at 4,750 r.p.m., the maximum torque being 141 lb-ft at 2,500 r.p.m.

In the Austin Princess saloon, the B.M.C. four-litre engine continues unchanged. With a compression ratio of 7·6:1, its output is 150 b.h.p. at 4,100 r.p.m. This same basic engine is fitted to the Jensen 541, with three, instead of two, S.U. carburettors and other special features. The new Jensen 541R saloon has the new B.M.C. DS7 engine, which is a more powerful version of the present Princess engine.

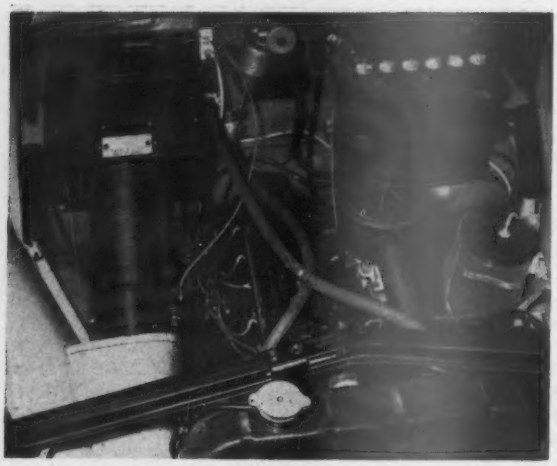
The policy of using four basic engines in the whole of the B.M.C. range now seems firmly established. Relatively minor variations of each type give considerable differences in power rating. The versions with low ratings can be expected to give exceptionally long, trouble-free service even if driven for long periods on full throttle.

**Ford**

None of the Ford engines has been subjected to any major modifications. The 1,172 cm³, side valve unit has a 6·2:1 compression ratio in the Popular and 7·0:1 in the Anglia and Prefect. In the Popular engine a Zenith carburettor is employed, while the latter two models have a Solex unit, which has a gross output of 36 b.h.p. at 4,500 r.p.m.



*The Humber Hawk engine, the compression ratio of which has been increased to 7·5 : 1, is shown here mounted on its display stand*



*A new six-cylinder, 2½ litre engine is now installed in the Vauxhall Velox and Cresta cars, and its rated output is 82·5 b.h.p. at 4,400 r.p.m.*

By contrast, the over-square, overhead valve units of the Consul and Zephyr models have a compression ratio of 7·8:1 and, for certain markets, 6·9:1; a full-flow oil filter is also fitted. The swept volume of each of the Ford engines is high relative to the vehicle weight. Ample performance is thereby obtained without rating the engines to their utmost, and a considerable measure of reliability can be expected. Ford practice is thus to use two basic engines, one of which is made in four-cylinder and six-cylinder versions.

**Rootes**

Hillman continue to employ the 1,265 cm³, side valve unit in the Husky. With a compression ratio of 6·6:1, a gross output of 36 b.h.p. at 4,100 r.p.m. is obtained. The 1,390 cm³, overhead valve unit is unchanged except for a redesigned camshaft. It is used with a Zenith carburettor in the Minx, and twin Zenith units in the Sunbeam Rapier. The Singer 1,496 cm³, overhead camshaft engine is still used in the Gazelle, which remains in production.

In the 2,267 cm³ engine of the new Humber Hawk, the compression ratio has been increased to 7·5:1. This unit, which has a single, Zenith carburettor and a by-pass oil filter, develops a gross output of 78 b.h.p. at 4,400 r.p.m. The Humber Super Snipe is no longer produced. Four different units are, therefore, still produced for five basic vehicle types, indicating that rationalization is not as yet being practised to its ultimate limit by Rootes.

**Standard**

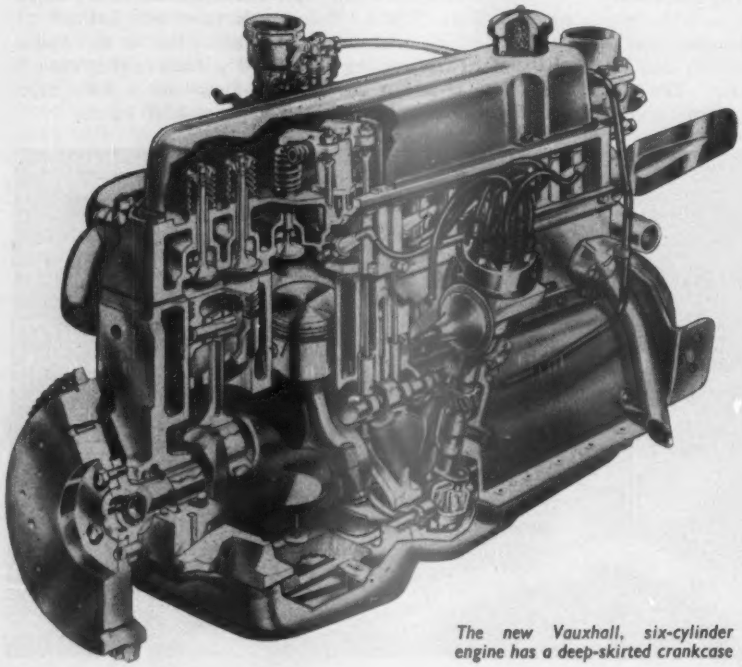
The Standard Eight and Ten engines are unchanged except for an increase in the compression ratio from 7·5:1 to 8·25:1. The 803 cm³ unit is of the four-cylinder layout, with a bore and stroke of 58 mm and 76 mm respectively, and it develops 33 b.h.p. at 5,000 r.p.m. In this car, the normal fuel consumption range is said to be 45-50 m.p.g., and an alternative main jet can be supplied for the Solex carburettor which, it is claimed, gives a further 5 m.p.g. The chassis is offered with overdrive as an optional feature; this should appeal to those users who are chiefly concerned with economy and relatively quiet operation at high speeds. The larger unit, of 948 cm³, is bored out to 63 mm, and develops a further 5 b.h.p. This engine is used in the Ten saloon and estate car, and also in the new Pennant saloon.

The 2,088 cm³ unit remains unaltered in the Vanguard saloon, but a new unit of 1,670 cm³ is now introduced and used in the Ensign saloon, which has the same size body as the Vanguard. This new engine has the same stroke, of 92 mm, as the 2,088 cm³ unit, but the bore, which is 76 mm, is smaller. With a compression ratio of 8·0:1, its gross output is 60 b.h.p. at 4,000 r.p.m. The Ensign is claimed to have a consumption range of 32-38 m.p.g., compared with 28-34 m.p.g. for the Vanguard. A similar engine, but with a bore of 83 mm and a capacity of 1991 cm³, is still used in the Triumph T.R.3 sports car, the addition of a full-flow oil filter being the only modification. In the case of Standard, two basic power units are therefore produced, and no further rationalization can be expected.

**Vauxhall**

The recently introduced Victor and Super Victor models are fitted with a new, 1½ litre, four-cylinder engine basically similar to that previously used in the Wyvern, which is now discontinued. The cylinder head is no longer stepped, so the holding-down bolts are now of equal length to give a more even pressure distribution on the gasket. For quieter operation, the gudgeon pin is offset $\frac{1}{16}$ in towards the thrust side of the piston, and the crankcase skirt now extends below the centre-line of the crankshaft. The siamesed inlet ports are replaced by individual ports, and larger inlet valves of 1·48 in diameter are used. These features have improved the breathing. Chromium plated top rings are now fitted to the pistons.

Bore and stroke dimensions of 79 mm and 76 mm respectively are retained, giving a swept volume of 1,507 cm³. A choice of two compression ratios, 7·8:1 and 6·8:1 is offered. With these ratios, power outputs of 54·8 b.h.p. at 4,200 r.p.m. and 52 b.h.p. at 4,000 r.p.m. are obtained respectively. The corresponding maximum torque figures are 84·5 lb-ft and 81·7 lb-ft, both of which are obtained at 2,400 r.p.m.

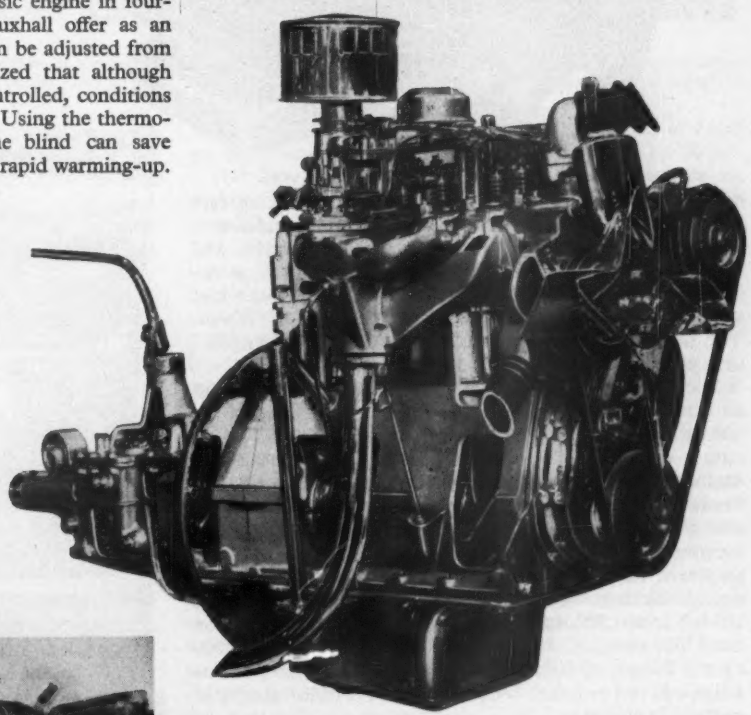


*The new Vauxhall, six-cylinder engine has a deep-skirted crankcase*

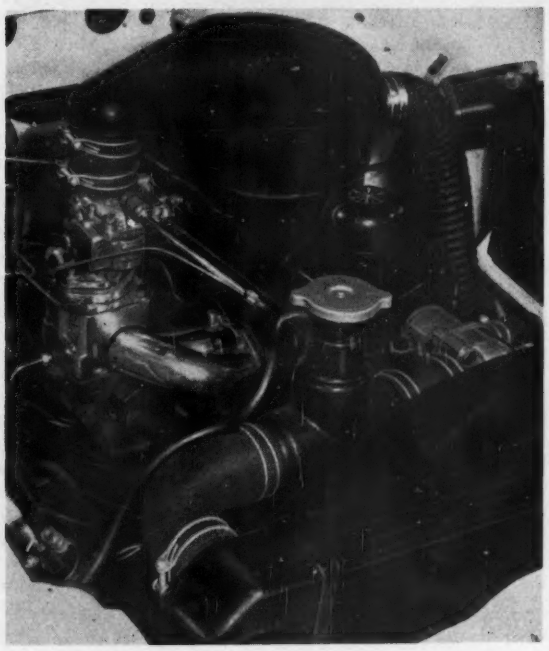
The new Velox and Cresta PA models are powered by a six cylinder unit, basically of similar design to the Victor engine. By comparison with the earlier engines of the same capacity, 2,262 cm³, the power output of this unit has been improved. The gains have been obtained by better breathing and an increased compression ratio. For example, the new engine with a compression ratio of 7·8:1 gives a gross output of 82·5 b.h.p. at 4,400 r.p.m., as compared with the 72·5 b.h.p. at 4,000 r.p.m. of the earlier unit with a 7·7:1 ratio. The corresponding maximum torque figures are 124 lb-ft at 1,800 r.p.m. and 114 lb-ft at 1,400 r.p.m. This improvement in torque is much more pronounced at the lower and higher ends of the speed range. A new Zenith 34VN carburettor is employed with the unit. Also, an automatic choke has now been introduced.

Since there is not a wide variety of sizes in the Vauxhall car range, it is possible to utilize one basic engine in four-cylinder and six-cylinder versions. Vauxhall offer as an optional extra, a radiator blind, which can be adjusted from the driver's seat. It is widely recognized that although the engine cooling is thermostatically-controlled, conditions can exist where overcooling is probable. Using the thermometer as a guide, intelligent use of the blind can save unnecessary engine wear, as well as assist rapid warming-up.

*Right: A power output of 33 b.h.p. is obtained at 5,000 r.p.m. with the Standard Eight engine*



*Below: This 1,670 cm³ version of the Vanguard engine is installed in the Standard Ensign*



**Other British manufacturers**

The compression ratio of the Rolls-Royce and Bentley 4,887 cm³ engine has been raised to 8·0:1, otherwise there are no changes. Performance figures for the engine are not published. A.C., Armstrong-Siddeley, and Rover report no engine changes.

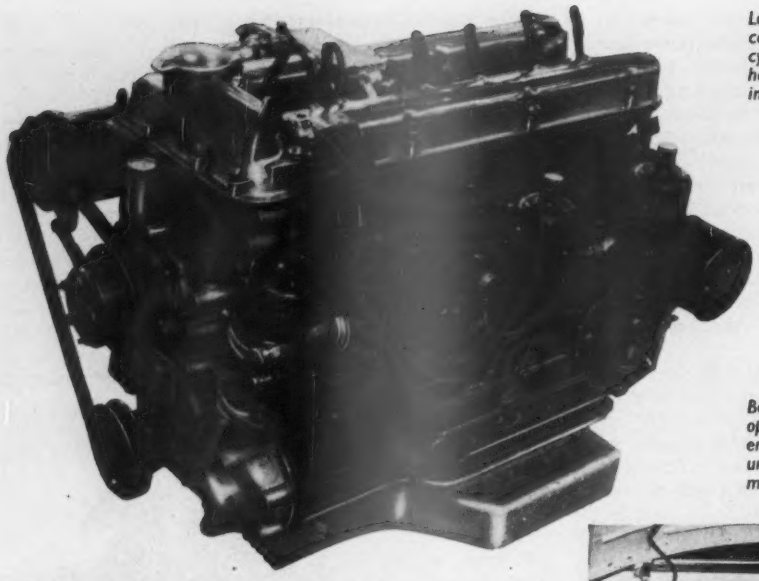
Among the Jaguar models, the XK150 replaced the former XK140 range earlier this year. The improved 3·4 litre, twin-overhead camshaft, six-cylinder engine has a bore of 83 mm and a stroke of 106 mm. With a compression ratio of 8·0:1, it develops 210 b.h.p. at 5,500 r.p.m., while the maximum torque is 216 lb-ft at 3,000 r.p.m. This represents the exceptionally high b.m.e.p. of 155 lb/in². The two carburettors are of the S.U. HD6 pattern, and a full-flow oil filter is employed. This same engine powers the 3·4 litre saloon, the Mark VIII saloon, and is optional in the new Allard Gran Turismo model. The smaller bore, 2·4 litre version, using twin Solex carburettors, and having a compression ratio of 8·0:1, produces 112 b.h.p. at 5,750 r.p.m.

The recently announced Daimler DK400B limousine has a six-cylinder 4,617 cm³ engine, with a compression ratio of 7·0:1. This unit now produces 167 b.h.p. at 3,800 r.p.m. the maximum torque being 260 lb-ft at 2,800 r.p.m.

In the new Frazer-Nash Continental coupé, the B.M.W. 502 type, V-eight engine, of 2,580 cm³ capacity, is employed. With a compression ratio of 7·8:1, and fitted with two twin-choke downdraught carburettors, the unit develops 140 b.h.p. at 5,000 r.p.m.

The new Alvis TC 108G coupé is powered by the Alvis 3 litre engine. With a compression ratio of 8·0:1, this unit delivers 104 b.h.p. at 4,000 r.p.m. The maximum torque is 152 lb-ft at 2,500 r.p.m.

An extensively modified 3 litre engine is employed in the Aston Martin DBIII saloon, now available on the home market. This six-cylinder unit has a bore and stroke of 83 mm and 90 mm respectively, and a compression ratio of 8·2:1. A newly-designed crankshaft is fitted, together with a heavier section crankcase. Wet liners have been retained, but seating at their upper ends to increase resistance to



*Left: The David Brown Aston Martin DB Mark III car has a 3 litre engine incorporating a new cylinder head, in which the valves and port design have been developed as a result of experience gained in racing and other competition events, as also have the recently adopted cam profiles*

distortion. Experience with the Aston Martin racing cars has led to the development of new cam profiles and a new head. The design still has twin-overhead camshafts, and full-flow oil filtration is used. With twin S.U. H6 carburettors and a dual exhaust system, the output is 202 b.h.p. at 5,500 r.p.m., when the mean piston speed is 3,250 ft/min. The maximum torque of 180 lb-ft occurs at 4,000 r.p.m.: this represents a b.m.e.p. of 152 lb/in².

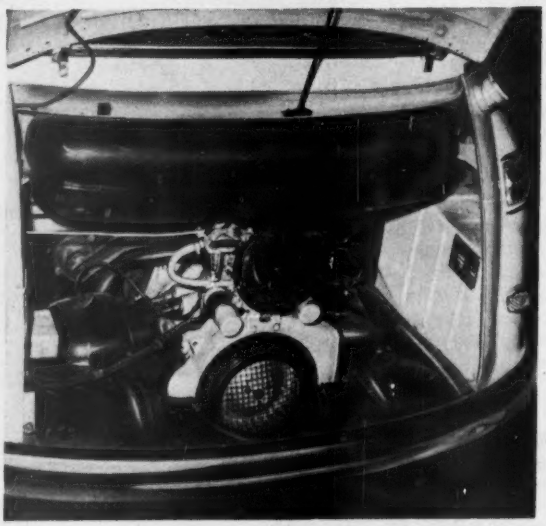
The new Bristol 406 saloon, which is for export only, has an enlarged version of the 2 litre Bristol engine used in the 405 model. With 10 per cent greater capacity, the power output of the later unit is the same as that of the 2 litre engine, but greater torque is obtained at lower speeds and flexibility is improved. This six-cylinder engine has a bore and stroke of 68·7 mm and 99·6 mm respectively, and a compression ratio of 8·5:1. Inclined, overhead valves are employed in a hemispherical head, and three Solex down-draught carburettors are fitted. The 2·2 litre engine develops 105 b.h.p. at 4,700 r.p.m., as compared with 5,000 r.p.m. on the 2 litre unit. The maximum torque is 129 lb-ft at 3,000 r.p.m., instead of 123 lb-ft at 3,750 r.p.m. This represents a b.m.e.p. of 144 lb/in², compared with 154 lb/in² developed in the 2 litre engine.

Lotus have introduced the new Eleven Le Mans 150, with a four-cylinder, twin-overhead camshaft engine of 76 mm bore and 80 mm stroke, giving a capacity of 1,460 cm³. The output is said to be 145 b.h.p. at 7,000 r.p.m. A second new model, the Elite coupé, has a Coventry Climax single-overhead camshaft engine, of 1,290 cm³ capacity, with an output of 75 b.h.p.

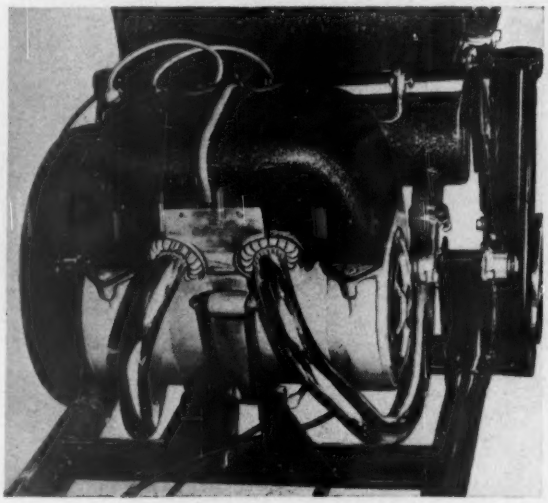
The Morgan 4/4 Series II, introduced in March as a competition model, has a four-cylinder, side valve engine of 1,172 cm³ capacity, with a bore and stroke of 63 mm and 93 mm respectively. Its compression ratio is 7·0:1, and with one Solex carburettor, the output is 36 b.h.p. at 4,500 r.p.m. In the Plus Four series of models, an engine identical to that of the Triumph T.R.3 is employed.

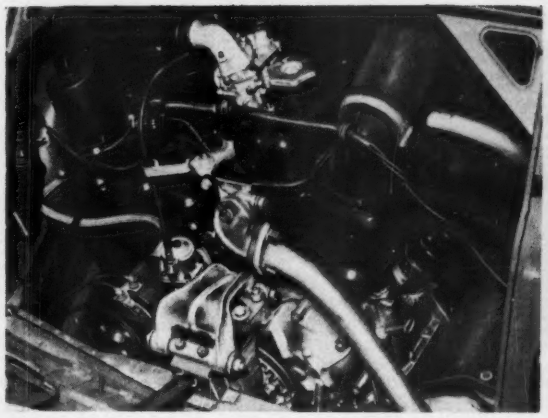
In the Fairthorpe Electron Minor the Standard Ten engine, without modification, is installed. This gives an outstanding performance in a chassis weighing only 8½ cwt. Another Fairthorpe model, the Atomota, is powered by a B.S.A. 646 cm³, two-cylinder, air-cooled engine. Its bore and stroke are 70 mm and 84 mm respectively, and the compression ratio is 6·5:1. The output is 35 b.h.p. at 5,700 r.p.m., and the maximum torque, which is quoted as being 36 lb-ft, is developed at an engine speed of 3,750 r.p.m.

*Below: At the rear of the new Isetta 600, a B.M.W. opposed twin-cylinder, four-stroke motor cycle engine is installed, and the track of the rear wheels, unlike that of the earlier Isetta model, is the maximum obtainable within the limits of the body*



*Below: A neat and compact engine installation is employed on the chassis of the Frisky miniature cars. The engine is a Villiers, two-cylinder, two-stroke, air-cooled unit that has a swept volume of 325 cm³*





*Twin-cylinder, four-stroke, air-cooled engine installation at the rear of the Fiat 500 saloon, which is a successor to the earlier Topolino*

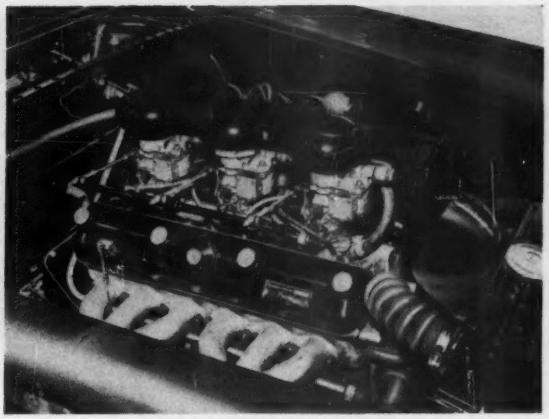


*Illustration showing the installation of the new 2·2 litre, six-cylinder, overhead valve engine used in the Bristol 406 saloon car for export*

A new engine has been introduced, as an alternative to the 328 cm³ unit, for the Berkeley range. It is an Excelsior unit with three cylinders in line, with a bore and stroke of 58 mm and 62 mm respectively and a capacity of 492 cm³. This unit is a two-stroke, air-cooled unit with a compression ratio of 7·5:1. Fitted with three Amal 376/9 carburettors, the engine develops 30 b.h.p. at 5,500 r.p.m.

Separate cast iron cylinder barrels with individual light alloy heads are used. A built-up crankshaft is carried in seven ball and roller bearings, and seals are used to isolate the separate crankcase compartments. Many of the components are common to the 328 cm³ unit. The performance of the car fitted with this engine should be considerably better than that with the two-cylinder, 18 b.h.p. engine, which powered the earlier models.

Among the miniature cars is the Frisky range manufactured by Henry Meadows Ltd. So far, there are two of them, known as the Frisky saloon and the Friskysport. They are both powered by a Villiers, two-cylinder, two-stroke, air-cooled engine. This unit has a bore and stroke of 57 mm and 63 mm, giving a capacity of 325 cm³. In the sports version, with a compression ratio of 8·2:1, it develops 22 b.h.p. at 5,500 r.p.m., but in the saloon, with a ratio of 7·5:1, the power output is 20 b.h.p. at 5,000 r.p.m.

**European models**

The DKW 1000 coupé and roadster each have a three-cylinder, two-stroke engine with a bore and stroke of 74 mm and 76 mm respectively, giving a capacity of 980 cm³. With a compression ratio of 8·0:1, this engine develops 50 b.h.p. at 4,500 r.p.m., the maximum torque being 66·5 lb-ft at 3,500 r.p.m. Expected to go into production shortly, but not shown at this year's exhibition, is the DKW 600, with a two-cylinder version of this engine; it is claimed to have an output of 30 b.h.p. at 4,200 r.p.m.

On the Borgward Isabella, the engine is almost unchanged. It is a four-cylinder engine of 1,492 cm³ capacity, now offered with a compression ratio of 8·2:1 and producing 75 b.h.p. at 5,200 r.p.m. The design incorporates a hemispherical combustion chamber, the valves being operated by long and short rockers and inclined tappets. A twin-choke carburettor and a by-pass oil filter are employed.

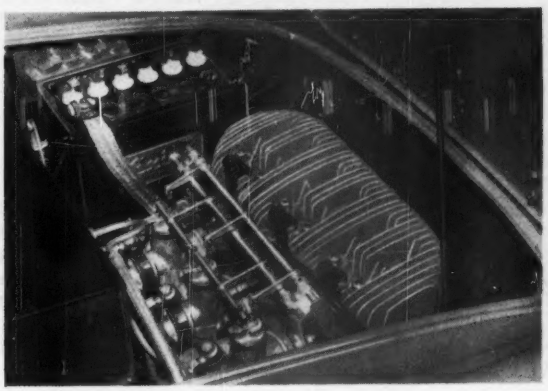
The Citroën engines are unchanged this year. The flat twin-cylinder, 425 cm³, air-cooled engine in the 2CV, four-seater saloon produces only 12 b.h.p. at 3,500 r.p.m., but this unusual vehicle continues to find a ready market. Another French car, the Facel Vega coupé, is powered by the Chrysler V-eight, 5 litre engine introduced two years ago. With a compression ratio of 8·5:1, the output is 260 b.h.p. at 4,600 r.p.m. The maximum torque is 335 lb-ft at 2,800 r.p.m., which represents the very high b.m.e.p. of 167 lb/in².

Fiat have reintroduced a 500, two-seater saloon in an entirely new form. The new air-cooled, vertical twin-cylinder, four-stroke overhead valve engine is situated at the rear. It has a bore and stroke of 66 mm and 70 mm respectively, giving a capacity of 479 cm³. The compression ratio is 6·6:1, and the manufacturers claim an output of 13 b.h.p. at 4,000 r.p.m. A maximum torque rating of 20·2 lb-ft at 2,500 r.p.m., representing a b.m.e.p. of only 104 lb/in², is obtained, so there is plenty of scope for further development. The 600 cm³, four-cylinder, water-cooled unit used on their other small car now has a compression ratio of 7·5:1, instead of 7·0:1. With this compression ratio, the engine now produces 22 b.h.p. at 4,600 r.p.m.

Mercedes-Benz continue to offer vehicles with petrol injection or a diesel engine, although the latter, which is popular for taxis, was not exhibited this year at Earls Court. The 3 litre, six-cylinder engine equipped with petrol injection, fitted to the recently introduced 300SL roadster, has a compression ratio of 9·5:1. It is rated at 250 b.h.p. at 6,200 r.p.m.; under these conditions, the mean piston speed is 3,580 ft/min. The maximum torque is 228 lb-ft at 5,000 r.p.m., and the maximum b.m.e.p. is 188 lb/in². Petrol consumption is quoted at 22·6 m.p.g. at 68 m.p.h.; this is a creditable performance, if realized under all conditions, and justifies the added expense of the injection pump.

The four-cylinder diesel engine offered unchanged on the 180 model is of 1,767 cm³ capacity, and has a compression ratio of 19·0:1. Its maximum torque, of 77 lb-ft at 2,000

*The Berkeley miniature car is now available with a three-cylinder two-stroke, air-cooled engine, made by the Excelsior Motor Co. Ltd.*



*Two Solex, twin-barrel, downdraught carburettors are installed on the Porsche engine*

r.p.m., represents a b.m.e.p. of 108 lb/in². This is exceptional for a diesel engine.

As exhibited, the Panhard Dyna engine is unchanged except for the introduction of a turbine type cooling fan. This engine, of course, has two, horizontally-opposed, air-cooled cylinders with a combined capacity of 850 cm³. Its compression ratio is 7·2:1 and, fitted with a Zenith-Stromberg carburettor, its output is 42 b.h.p. at 5,000 r.p.m.

In the Porsche Super cabriolet, the compression ratio of the 1,582 cm³ engine has been increased from 7·5:1 to 8·5:1. This unit develops 75 b.h.p. at 5,000 r.p.m. It is equipped with two Zenith double-choke carburettors. The Skoda 450 sports coupé is fitted with a modified 440 engine, which has a swept volume of 1,089 cm³ and a compression ratio of 8·4:1 instead of the 7·0:1 of the standard version. This engine produces 50 b.h.p. at 5,500 r.p.m., whereas the standard version develops 40 b.h.p. at 4,200 r.p.m.

A new Simca Montlhéry 58 saloon is introduced with the so-called Fash engine, giving greater power. This unit is of the four-cylinder layout, with a bore and stroke of 74 mm and 75 mm respectively; thus, its swept volume is 1,290 cm³. With a compression ratio of 7·8:1, the output is 57 b.h.p. at 5,200 r.p.m. The engine has an aluminium head, and a Solex 32 PBIC carburettor.

Alfa-Romeo have recently introduced the Giulietta T.I. saloon. It is equipped with the more powerful version of the 1,290 cm³ engine previously employed. This four-cylinder twin-overhead camshaft engine has a compression ratio of 8·0:1, and produces 65 b.h.p. at 6,000 r.p.m. Its maximum torque is 80 lb-ft at 4,000 r.p.m., which represents a b.m.e.p. of 153 lb/in².

The Volkswagen, four-cylinder horizontally-opposed, air-cooled engine is almost unchanged. It is of 1,192 cm³ capacity and, with a compression ratio of 6·6:1, develops a gross output of 36 b.h.p. at 3,700 r.p.m. An improvement has been made to the air intake arrangement, to prevent water from entering the engine in wet weather.

A new B.M.W. Type 502S limousine was exhibited. It is powered by the Type 503 engine, which is similar to the 2,580 cm³ unit fitted to the Frazer-Nash. With a bore of 82 mm, its swept volume is 3,168 cm³, and the gross output is 140 b.h.p. at 4,800 r.p.m.

B.M.W. also manufactures, under licence, the Isetta miniature car, as also does Isetta (Great Britain) Ltd. A new model, with orthodox four-wheel spacing, is added to the range. This latest version has an overhead valve, opposed-twin-cylinder, air-cooled engine, of 585 cm³, which is installed at the rear. The unit, which is of the four-stroke type, has a compression ratio of 6·5:1. It is a derated version of the well known motor cycle unit, and has a single downdraught carburettor. Air cooling of the cylinders is effected by a ducted fan; warm air is passed over the inlet pipe and can also be used for car heating. A separate system, using exhaust heat, is available for demisting the windscreen. A dual coil supplies the ignition from a low-tension distributor, and a full-flow oil filter is fitted. Its power output has been reduced from the 28 b.h.p. of the motor cycle version to 19·5 b.h.p. at 4,000 r.p.m. The torque curve is relatively flat, with a slight peak of 29 lb-ft at 2,500 r.p.m., representing a modest b.m.e.p. of 122 lb/in².

Goggomobil no longer use the 245 cm³ engine, but have introduced instead a larger alternative to the standard 293 cm³ engine. This new engine is a parallel-twin two-stroke, air-cooled unit of 392 cm³. With a single Bing carburettor, its gross output is 20 b.h.p. at 5,000 r.p.m. The prototype four-seater saloon, fitted with a 600 cm³, four-stroke flat-twin engine, was not shown at Earls Court.

An unusual feature of the Zundapp Janus is that it has a centrally-mounted engine, with seats arranged in front of and behind it, the rear seats facing backwards. The power unit is of the single-cylinder, two-stroke design. Its swept volume is 247 cm³, and it has a 6·7:1 compression ratio. Either a Bing or a Solex carburettor is employed, as well as a pneumatically-operated fuel pump and a combined generator and starter. The maximum output of 14 b.h.p. and the maximum b.m.e.p. of 78 lb/in² are both developed at about 5,000 r.p.m. At the maximum recommended engine speed of 6,000 r.p.m., the mean piston speed is 2,760 ft/min.

The smallest engine of all those in the cars exhibited was that in the Heinkel Cabin Cruiser. It is a 198 cm³ unit, mounted at the rear. In earlier models, a 174 cm³ unit was employed. The latest one is a single-cylinder, four-stroke, air-cooled unit of 64 mm bore and 62 mm stroke. With magneto ignition and a Pallas 22/15P carburettor, the engine develops 10 b.h.p.

**American engines**

Most of the American power units are of 90 deg V-eight, over-square design, with a single camshaft, carried centrally above the crankshaft to actuate the push rods and rockers of the inclined overhead valves in each head. Generally, they are equipped with centrally-mounted, four-barrel, downdraught carburettors with automatic chokes, and a single, large air cleaner. Compression ratios of up to 10·5:1 are used, and full-flow oil filters are generally adopted.

Maximum power is developed in the region of 4,500 r.p.m., and maximum torque at about 2,500 r.p.m. In many instances the torque is equivalent to the surprisingly high b.m.e.p. of 165 lb/in². Most of these engines are of more than 5 litres capacity and some are even of more than 6 litres. However, a number of smaller American engines continue to be offered. These are of about 3 litres capacity and are of conventional overhead valve, six-cylinder design.

The American Motors Corporation, comprising Hudson and Nash, still offer the six-cylinder, 3·2 litre engine in the Rambler saloon. Fitted with one Carter carburettor, its gross output is 127 b.h.p. at 4,200 r.p.m. The Ambassador, 5·4 litre V-eight unit is over-square; it produces 270 b.h.p. at 4,700 r.p.m., the mean piston speed being 2,540 ft/min.

A 6·4 litre V-eight engine is now employed in the Chrysler

Imperial. This unit has a 10·0:1 compression ratio, and develops its maximum gross power, of 330 b.h.p., at 4,600 r.p.m. The Dodge Kingsway saloon has a V-eight engine of 5·2 litres swept volume, with a 9·0:1 compression ratio. This unit is rated at 290 b.h.p. at 5,300 r.p.m., when the mean piston speed is 2,920 ft/min.

General Motors Ltd., showed three Oldsmobile cars, each fitted with a 6·1 litre V-eight engine, introduced since last year. The output of this engine is 277 b.h.p. at 4,400 r.p.m., and the maximum torque of 400 ft-lb at 2,800 r.p.m. corresponds to a b.m.e.p. of 162 lb/in². This unit is equipped with a Rochester 4GC four-barrel carburettor.

A new car from the General Motors Canadian factory is the Chevrolet Bel-Air coupé, powered by a 4·3 litre, V-eight engine with a compression ratio of 8·0:1; this compression ratio is low by American standards. The gross maximum power is quoted as 162 b.h.p. at 4,400 r.p.m. A maximum torque of 257 lb-ft is developed at 2,400 r.p.m.; this represents a b.m.e.p. of 146 lb/in². The Chevrolet engine with petrol injection was not shown at the London exhibition this year.

Buick and Cadillac models introduced since the previous Show have a V-eight unit of 6·0 litres capacity and a 10·0:1 compression ratio. When equipped with a four-barrel carburettor, this engine develops 300 b.h.p. at 4,600 r.p.m. An optional feature on the Cadillac engine is an installation comprising two, four-choke carburettors, which, it is claimed, raises the power to 350 b.h.p.

The new Edsel saloon has a 6·7 litre engine of 10·5:1 compression ratio. A rated output of 345 b.h.p. is claimed. Its maximum torque, of 475 lb-ft at 2,900 r.p.m., corresponds to the very high b.m.e.p. of 175 lb/in². The Ford Thunderbird has a racing type body, with a 5·1 litre engine, having a compression ratio of 9·7:1. It develops its gross maximum power of 265 b.h.p. at 4,800 r.p.m. This engine is offered with a supercharger for increased output.

In the Packard Hawk coupé, the Studebaker 4·7 litre, V-eight engine, fitted with a McCulloch supercharger, is employed. A variable-speed drive is used for the supercharger and is controlled by the throttle opening, to provide about 5 lb/in² boost at maximum throttle. The gross rating of the engine is 275 b.h.p. at 4,800 r.p.m., and the maximum torque of 333 lb-ft, obtained at 3,200 r.p.m., represents a b.m.e.p. of 174 lb/in². The Studebaker Champion is unusual in having a six-cylinder, side valve engine. This unit has a swept volume of 3 litres and a compression ratio of 7·8:1. It is a long stroke engine and, at its maximum gross power output of 101 b.h.p., the mean piston speed is 2,920 ft/min. The maximum b.m.e.p., at 1,800 r.p.m., is 123 lb/in².

An interesting vehicle shown on the Pontiac stand was the Club de Mer experimental sports car. In this vehicle, a 5·2 litre V-eight engine is installed. The layout is unusual in that the synchromesh gearbox is mounted with the differential, and a de Dion rear axle layout is employed. The engine, which has a compression ratio of 10:1, is fitted with dual four-barrel downdraught carburettors and has four exhaust pipes. Its rated output is given as 300 b.h.p.

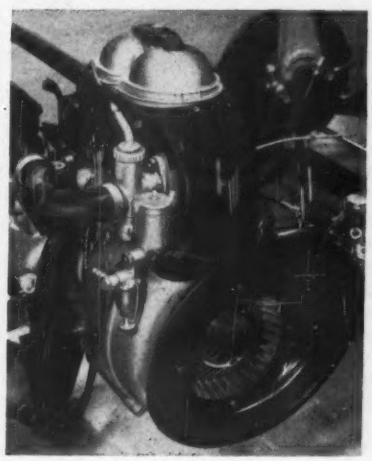
# CARBURATION AND INDUCTION

## *Short Downdraught Carburettors Increasing in Popularity, and a Trend Towards Separate, Instead of Siamesed, Ports*

LAST year saw the introduction, by British carburettor manufacturers, of extra short, downdraught instruments, designed to fit into the increasingly restricted space that is left in the engine compartment as the stylists continue to lower the bonnet-line. At the Motor Show this year, there was evidence that these short downdraught carburettors have been more widely employed and, as lower bonnet-lines become more general, it is expected that they will be introduced in still greater numbers. Experience gained in development and production during the last few years has proved that these short carburettors perform extremely well. However, because of the closer proximity of the float chamber to the heat of the induction and, in most cases, that of the exhaust manifold also, more care is necessary to ensure that these carburettors are shielded effectively from radiated and conducted heat. This is necessary, not simply to avoid vapour troubles—for these carburettors incorporate vapour-release systems in the design—but also to prevent loss of fuel by evaporation, which can be an important factor so far as fuel consumption is concerned.

The popularity of the downdraught carburettor continues unabated. Most of the vehicles exhibited were equipped with carburettors of the downdraught pattern in the single-barrel, twin-barrel, or four-barrel form. On the British exhibits, the downdraught carburettors were nearly all of the single-barrel type. A number of Continental exhibits were equipped with Solex twin-barrel instruments; the four-barrel downdraught versions were confined to the American products.

These four-barrel carburettors are, of course, compound instruments, as also are some of the Continental twin-barrel carburettors. Compound carburation systems are by no means new: they have long been used by linking two or more single carburettors together so that one barrel comes into action after the other. With modern compound systems, however, this action is employed with both twin- and four-barrel carburettors. In the twin-barrel instruments, one barrel is used for part-throttle operation, the second barrel being brought into action automatically when full power is required. If there are four barrels, two primary



*The Bing horizontal carburettor and air silencer arrangement on the Isetta 300*

*Solex downdraught carburettor and the air intake on the Fiat 500*

barrels supply mixture for part-throttle running, and the other two come into operation for maximum power. These large four-barrel carburettors have become almost universally used on American V-eight engines; being squat in design, they fit in the middle of the V, where the under-bonnet headroom is greatest.

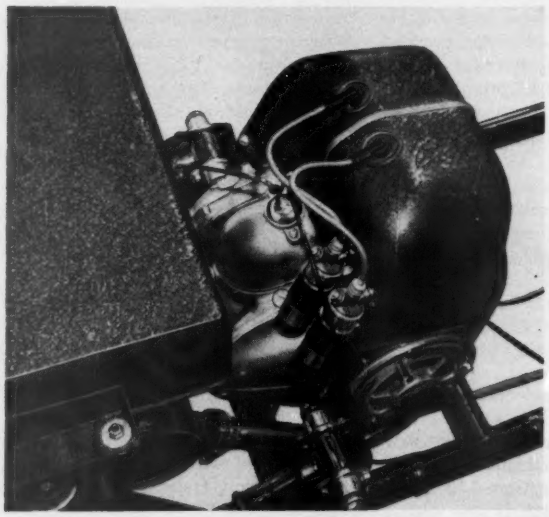
On the vehicles exhibited at the Show, the downdraught carburettors, whether single-, twin- or quadruple-barrelled, were all of the open-choke type. However, a number of vehicles were equipped with the S.U. constant vacuum instrument, fitted either horizontally or inclined at a small angle to the horizontal. The latter arrangement has become known as the semi-downdraught layout. Carburettors of this type were, in the main, confined to British products. All the American exhibits were fitted with open-choke carburettors, as were the majority of Continentals.

Economy systems for cruising, together with high-power enrichment and accelerator pumps, have become widely used on all open-choke carburettors of the medium and larger sizes. Among the cold starting devices employed is the offset-mounted strangler valve type with a linkage for fast idling, as exemplified by Zenith and Zenith-Stromberg, and on the American contingent by Stromberg, Carter, Holley and Rochester. Another is the auxiliary starter carburettor of the Solex type. On the S.U. constant vacuum instrument, enrichment for cold starting is obtained by lowering the jet sleeve round the needle. This in many instances, is operated in conjunction with a linked fast idle device to open the throttle valve a predetermined amount. A few of the cars exhibited were fitted with the S.U. automatic starter carburettor. This is a small auxiliary carburettor that is brought into action by a thermostat control in the cooling system.

There is still a marked difference between the starting devices of the British and American cars. Nearly every American exhibit was fitted with an automatic choke, so the driver has no control whatever of the mixture during the cold starting and warm-up period. In the United Kingdom, the popularity of this device has declined, and few British cars were so equipped. The automatic systems appear to be gaining a little ground, however, on Continental cars, and several French cars are fitted with the Solex automatic starter carburettor. It was interesting, therefore, to observe that Vauxhall, with their new Velox and Cresta, have entered the field with an engine fitted with a carburettor having an automatic choke of the hot-air type. Except for the new feature, this instrument, known as the Zenith 34-VNT unit, is similar in design to the 34-VN introduced on the Vauxhall models that were exhibited at the Show last year.

At Motor Shows, there is always a wide variety of induction and exhaust system designs to be seen. Now there appears to be a trend away from siamesed porting, towards the employment of separate exhaust ports with the inlet ports between them. This is done mainly to obtain better cooling of the exhaust valves, and is a most commendable feature. One example of this layout is the Vauxhall Victor, where each of the outer exhaust ports is separated from its neighbouring exhaust port by an inlet port, while between the exhaust ports of cylinders 2 and 3 there are two inlet ports. A similar arrangement is used on the new Velox engine. It seems likely that in the future more examples of this type of design will be introduced.

As in previous years, exhaust-heated hot-spots are in the majority. Convenience in design probably has a great deal to do with this: with the conventional squish type combustion space, there is much to commend the arrangement of the induction and exhaust manifolds together on one side of the engine, with the induction above the exhaust, and the two joined in the centre to form the hot-spot. When the hemispherical type of combustion chamber is employed, condi-



*On the Meadows Frisky, the Amal horizontal carburettor is neatly encased in the domed aluminium alloy casting adjacent to the two ignition coils, which can be seen in the middle of this illustration*

tions are altogether different. Nearly every exhibit with this form of cylinder head layout had the induction manifold on one side of the engine and the exhaust on the other. In all the examples of this design exhibited, the induction tracts are jacketed, and heated by the engine coolant.

On the American V-eight power units, exhaust-heated hot-spots are almost universal. The general arrangement is to feed exhaust gases from the exhaust manifold of one bank of cylinders to the other, through channels in the induction casting, the flow being regulated by a thermostatically-controlled heat valve in one exhaust manifold. An exception is the new Edsel Citation, the engine of which is the first of the modern V-eight power units in which the coolant is employed for heating the induction system. A three-stage thermostat control unit is employed to regulate the coolant flow and maintain the required temperature at the hot-spot.

There is little change in the general design of the American V-eight induction systems. All retain the central, cast manifold, which bridges the V and which contains a complex arrangement of passages for the flow of mixture. The induction channels are interweaved over and under one another, one barrel or pair of barrels of the carburettor

feeding the two inner cylinders of one bank and two outer cylinders of the other, and *vice versa*. Thus, the riser tracts are of different lengths, but this does not appear to have any ill effects. Exhaust gases are fed from one cylinder bank across and through the riser hot-spot jackets to the other bank. In most instances, there is a thermostatically-controlled heat valve in the exhaust manifold of one bank; this ensures that while the engine is warming up there is a full flow of exhaust gas through the hot-spot jacket. In addition it cuts off the supply when the engine is at normal running temperature.

**Miniature cars**

The majority of the new miniature cars exhibited had two-stroke engines, generally with twin-cylinders. These were for the most part equipped with motor cycle type carburettors. One example of this layout was the Meadows Frisky. In this vehicle, the Villiers twin-cylinder, air-cooled engine is mounted at the rear of the car, and a Villiers S-25, single horizontal, motor cycle type carburettor is employed. It feeds the two cylinders through a short, forked induction manifold, bolted on to the rear of the cylinder block. A metal deflector plate shields the carburettor from heat radiated from the cylinders, and a small aluminium casting fits over the carburettor; this casting blends with the crankcase to present a very neat appearance. Fuel supply to the carburettor is by gravity feed from a petrol tank mounted above the rear axle, the filler cap being on top of the body, behind the seat. From the front of the engine cylinders, the exhaust pipes curve down and under the engine to the silencer, which is mounted transversely on the frame. The tail pipe leads out from the middle of the silencer body.

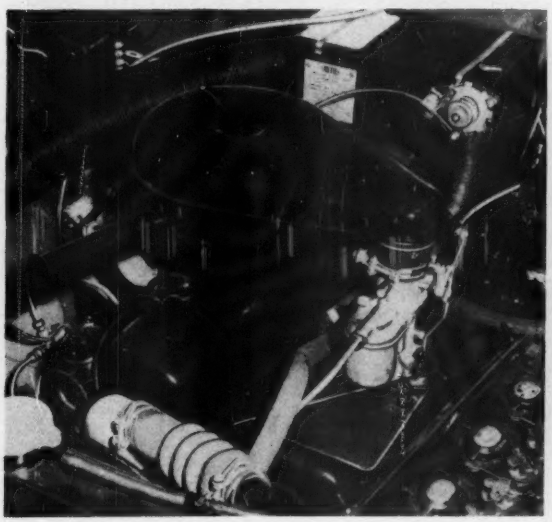
When first introduced, the Berkeley was fitted with a twin-cylinder, two-stroke power unit. This version is still retained, but the new 500 model has an Excelsior, three-cylinder two-stroke, vertical engine, each cylinder being fed by a separate Amal carburettor. There are no air silencers, but each carburettor has a flared air intake trumpet of conventional pattern. Two layshafts, working independently and carried by separate brackets, operate the throttles and mixture controls respectively. An S.U. electric fuel pump installed on the right-hand side supplies fuel to the carburettors. Since the carburettors and inlet ports are at the rear, the exhaust pipes are taken from the front of the engine cylinders and lead down to the exhaust silencer under the left-hand side of the engine compartment.

*A two port-branch induction system and an inclined, S.U. carburettor are employed on the recently introduced, Wolseley Fifteen Hundred*

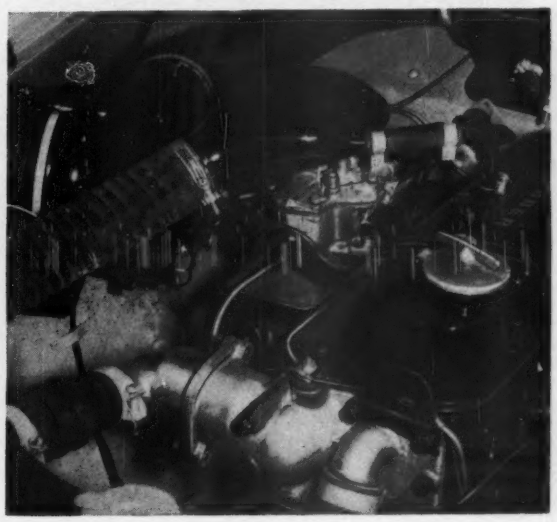
On the B.M.W. Isetta 300, a B.M.W. single-cylinder four-stroke engine is employed. It is equipped with a small Bing carburettor. A refinement worthy of note on such a small vehicle is the glass bowl petrol filter, which is attached to the petrol inlet of the carburettor. Another such refinement is the air silencer. This is a cylindrical unit installed remote from the carburettor and connected to it by a curved length of rubber hose.

Also exhibited was the B.M.W. Isetta 600, powered by an opposed, twin-cylinder, air-cooled, four-stroke engine, installed at the rear. A single, horizontal carburettor, centrally positioned, supplies the long induction pipe feeding

*The Zenith 30-VM8 downdraught carburettor installation, as now fitted on the Hillman Minx Series II Jubilee, 1,390 cm³ engine. It has a larger venturi than that employed on the previous model that it succeeds*



*Another of the Rootes Group products, the Humber Hawk, is equipped with the Zenith, 36-WIA, short downdraught carburettor, which incorporates the anti-percolation emulsion and air bleed arrangements*



each cylinder. The junction between the carburettor and manifold is jacketed. This jacket is served by two pipes, the ends of which are brought down to take warm air from the vicinity of the exhaust port flanges, inside the air ducts from the cooling fan. A small air silencer is fitted to the mouth of the carburettor. The exhaust silencer is on the right-hand side of the engine, a single tail pipe protruding to the rear.

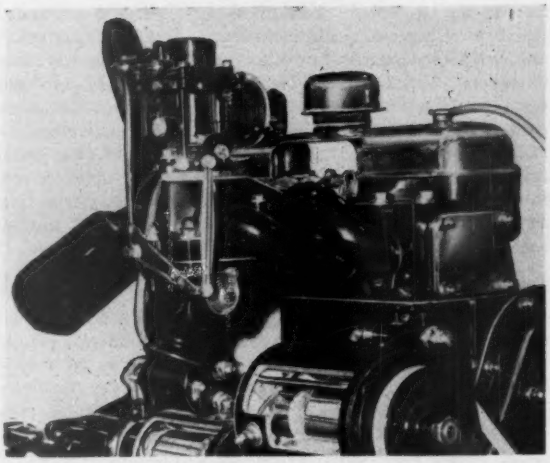
A newcomer to the Fiat range is the 500 cm³ model, which is powered by a vertical, air-cooled, twin-cylinder, four-stroke engine at the rear. The combustion space is wedge-shaped, with push-rod-operated valve gear. A single, Weber downdraught carburettor delivers mixture through the almost vertical, siamesed induction tract to the inlet valve ports, which are adjacent to one another. Thus one of the exhaust ports faces the front and the other the rear, an arrangement which gives excellent cooling of the exhaust valves and ports.

The air supply for the carburettor is taken from the delivery side of the fan that serves the engine cooling system. An 8·8 in diameter, centrifugal fan is employed and is driven at 1·75 times crankshaft speed. It draws its air from a capacity-box below the rear light of the body. From there, the air is taken past a thermostatically-controlled flap valve into the large diameter, reinforced hose to the fan casing. Thence it is blown through the baffles that surround the engine cylinders.

Two tubes lead out from the casing, one large and one small: the smaller tube leads to the intake side of the thermostatically-controlled flap valve. Thus, provision is made for recirculation of warm air, the arrangement being such that the supply of warm air back to the fan is not shut off until the ingoing air reaches a temperature of 22 deg C.

The air supply for the carburettor is taken through a silencing, venturi by-pass, between the cooling fan and the cylinder casing, and thence into the air cleaner. This device ensures that the temperature of the air flow to the carburettor is almost constant, thus providing some suppression of detonation in summer and of icing in winter. Air from the larger tube connected to the casing is taken forward into the tunnel enclosing the control gear. A manual control is incorporated so that the air can be directed either through this tunnel into the interior of the body, for heating, or to atmosphere.

Fuel is supplied from the tank to the carburettor by means of a mechanically-actuated fuel pump on the left, at the rear



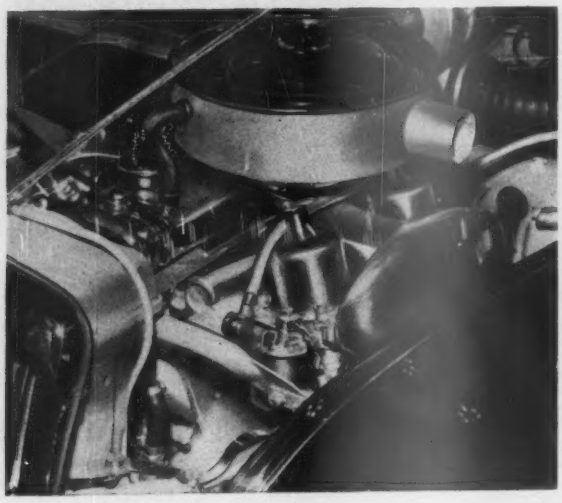
*A moulded plastics link is employed in the throttle control of the Solex downdraught carburettor installed in the Renault Dauphine engine*

of the engine crankcase. There is no exhaust manifold as such. Since one of the exhaust ports faces the front and the other the rear, a cast iron elbow-piece, connected to a pipe leading outwards and down to the exhaust silencer, is bolted to each. The tail pipe is taken from the middle of the silencer, and leads out to the rear of the vehicle.

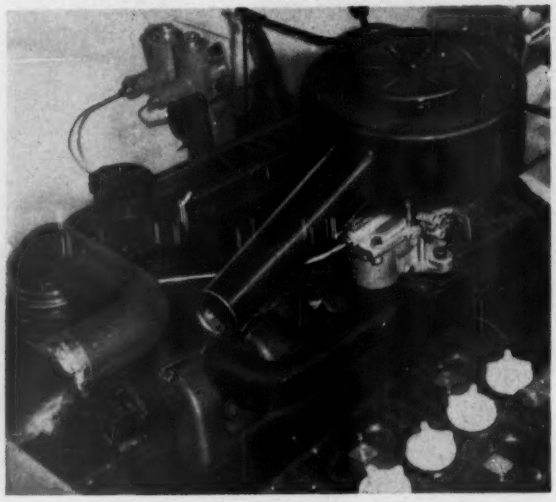
**Four-cylinder engines**

An outstanding example of the recent trend towards the adoption of larger power to weight ratios is the Wolseley 1500. The B.M.C. 1500 cm³ power unit employed is basically the Series B engine, which develops a gross output of 50 b.h.p., and an installed output of 43 b.h.p. at 4,200 r.p.m. Both the induction and the exhaust manifolds are on the left-hand side, the inlet ports being siamesed, in the usual B.M.C. fashion, with exhaust ports at the front and rear, and in the centre. Fuel is delivered by an S.U. electric pump, installed slightly above the fuel tank on the extreme right-hand side of the boot, to a single S.U. carburettor. This carburettor, which is installed in the semi-downdraught position, serves a circular section, cast iron induction manifold, the galleries of which turn inwards in gentle curves to

*Inclined, twin S.U. carburettors are employed in conjunction with an oil bath type air cleaner on the M.G. Magnette, four-cylinder engine*



*On the Vauxhall Cresta and Velox, the hot air supply for the automatic choke is taken from a small box on the rear of the exhaust manifold*



the cylinder head ports. A large boss on the exhaust manifold is bolted up to the induction manifold, just below the riser junction, to form a contact hot-spot. The A.C. circular oil bath air cleaner is mounted towards the rear, above the rocker cover. Connection between the air inlet of the carburettor and the silencer is effected by a fabricated duct. An engine breather pipe is led directly into the side of the air cleaner body. On this model, the take-off for the exhaust manifold is to the rear of the engine and points backwards and down. The exhaust pipe leads back to the single exhaust silencer just in front of the rear axle.

On the Mercedes-Benz 180, the original 1,767 cm³ side valve engine has been discarded in favour of a 1,897 cm³ overhead valve power unit, with a single overhead camshaft driven by a chain. The valves, which are staggered, have desmodromic actuation gear. This engine is similar in many respects to that of the 190. In general, the 180 is a de-rated version, with a lower compression ratio and a single-barrel carburettor instead of the Bosch injection system. It develops a gross output of 74 b.h.p.

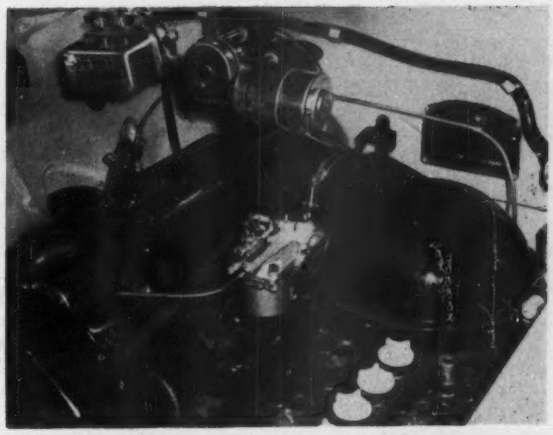
Both the induction and the exhaust manifolds are on the right-hand side of the engine, with the induction above the exhaust in the conventional manner. A single, Solex downdraught carburettor supplies mixture to the circular section, induction manifold, which is an aluminium casting. A contact hot-spot flange, underneath the riser T-junction, is bolted to a corresponding flange on the exhaust manifold. From the riser T-junction, both galleries rise slightly before turning down again and inwards to meet the inlet valve ports in the cylinder head. This arrangement of the induction tract is doubtless to avoid excess wet fuel from reaching the cylinders during the warm-up period.

The Hillman Minx Series II Jubilee, 1,390 cm³ engine is now equipped with a camshaft designed to give high torque characteristics in the low and middle range. It has a Zenith 30-VM8 downdraught carburettor with a larger venturi than that employed on the previous model. This carburettor is a fixed venturi version, as distinct from the Zenith 30-VI used on the Mark VIII and early Series I Minx models. It differs from the 30-VI unit chiefly in that its venturi is cast integrally with the main body of the carburettor, instead of being separate. Control of the throttle is now effected by a Bowden cable from the accelerator pedal. An A.C. air silencer of the pancake pattern is fitted directly on to the air intake.

No alteration has been made to the induction system, which comprises a four port-branch, cast iron manifold with the four-port exhaust manifold below. The two castings are bolted together in the conventional manner at the centre. A thermostatically-controlled heat valve is retained. For the control, a coiled thermostat spring and bob weight of the usual kind are employed. The fuel feed to the carburettor is effected by means of an A.C. mechanical fuel pump. On this engine, the end of the manifold drain pipe is reduced to a small diameter instead of being fitted with a non-return ball valve.

Introduced earlier in the year, the new Humber Hawk has a four-cylinder power unit, basically similar to that employed in previous versions of this model. The bonnet crown on this new car is lower than before, but there is sufficient headroom under the bonnet to accommodate one of the recently introduced, Zenith short downdraught carburettors.

Both the induction and the exhaust systems are placed on the right-hand side of the engine, the induction being the uppermost. Separate inlet ports are employed, but they are arranged in pairs at each end of the rake type, induction gallery. Thus, the order of porting, taken from the front of the engine, is exhaust, inlet, inlet, exhaust, exhaust, inlet, inlet, and exhaust. A D-section induction gallery is employed,



*A Zenith 34-VN short downdraught carburettor is used in conjunction with a four-port induction system on the Vauxhall Victor*

the flat being horizontal and forming the floor. The front and rear tracts slope up steeply from the riser junction. Buffer ends are provided, the gallery being extended about half an inch past the junction between it and the outer ports. The induction manifold is of cast iron, and the whole of the junction between the riser-T and the gallery is jacketed for exhaust gas, which is directed upwards by the thermostatically-controlled heat valve. Following usual practice in this country, the heat valve spindle is in the exhaust manifold casting and is parallel to the crankshaft. The bi-metal thermostat spring is at the rear, and is protected from draughts by a small sheet metal cover.

For many years, the Rootes Group have employed a ball valve in the manifold drain tube on their larger models, but on the new Hawk the ball valve has been discarded, the outlet end of the tube being reduced in diameter, as on the Minx. The exhaust system follows conventional practice, the off-take and down-pipe leading from the centre of the manifold casting, below the heat valve, to a single exhaust silencer at the rear.

The Zenith 36-WIA, short carburettor has a double-venturi airflow system with anti-percolation emulsion and air bleed arrangement. An economizer is incorporated to give part-throttle economy, as well as maximum power mixture; it is regulated by a suction-operated diaphragm. In this version of the Zenith range, the economizer system operates on the power jet principle, as distinct from the variable air bleed economizer of the 34-VN models. Thus, the mixture strength is proportional to the induction depression. The acceleration pump is mechanically-operated, by a linkage connected to the throttle spindle. For cold starting, an offset-mounted strangler valve is provided: the automatic strangler movement is governed by the action of a light spring, which operates against the action of the air flow on the offset valve. A linked fast-idle arrangement sets the throttle open to a pre-determined amount when the strangler is fully closed. The throttle body forms a separate casting, and an insulating gasket, some $\frac{1}{4}$ in thick, separates it from the main body casting.

A fabricated sheet metal air intake, of the tennis racquet form commonly employed on Rootes models, fits over the carburettor air inlet. It is connected to the oil bath air cleaner by a length of corrugated hose. The cleaner is attached to the valance panel on the right-hand side, and the silencer tube extends forward through a grommetted orifice beside the radiator to take in cool air in summer conditions. For winter operation, the air cleaner can be turned round, so that the silencer tube points back into the area of warm air adjacent to the manifolds. To avoid undue air flow

disturbance when the silencer tube is facing forwards, a metal baffle plate is secured behind the radiator grille. A breather tube is taken from the rocker cover into the metal air intake fitted to the carburettor inlet. Fuel is lifted by an A.C. mechanical fuel pump, mounted on the left-hand side of the engine, where it is remote from the exhaust manifold.

The port layout on the new Vauxhall Victor is an example of the latest trend in design, in which the induction and exhaust ports are arranged alternately instead of in pairs, as mentioned previously. Both manifolds are on the left-hand side of the engine. The induction manifold is the four port-branch type, and the exhaust manifold is below it. Both are of cast iron. This engine has the same bore and stroke as the Wyvern, 79·37 mm × 76·2 mm, but on the earlier model a two port-branch induction manifold with siamesed inlet valve ports was employed. On the Victor engine, the port sequence arrangement, starting from the front, is: exhaust, inlet, exhaust, inlet, inlet, exhaust, inlet, exhaust. In other words, all the exhaust ports are separated from one another by inlet ports. Improved breathing is obtained by employing larger inlet valves than in the Wyvern.

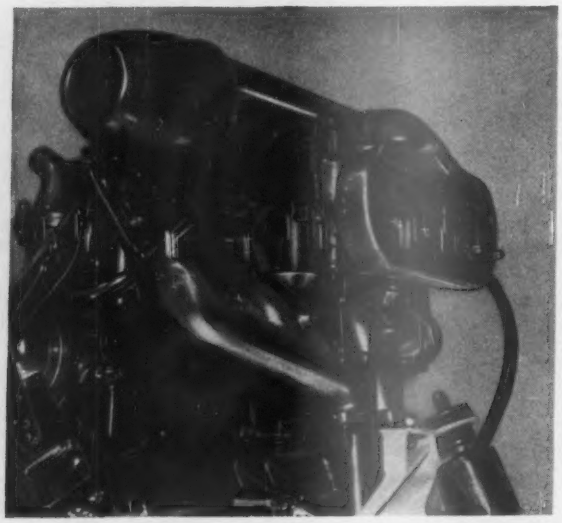
Following previous Vauxhall practice, the induction manifold is of cast iron, and of D-section, to give a flat floor. As the two main galleries feeding cylinders 1 and 4 leave the riser junction, they slope upwards slightly towards the point where they turn inwards in a short radius bend to the cylinder head ports. The inlet valve ports of cylinders 2 and 3, being adjacent, are fed by two short port-branches, which have only a very short separating wall where they leave the riser junction. This is sufficient to prevent excess liquid from reaching the cylinders, and the head port tracts rise slightly to the point where they turn downwards to the vertically-placed inlet valves.

Another well-known feature common to Vauxhall engines is the thermostatically-controlled heat valve. The riser T-junction is jacketed and supplied with exhaust gas from the manifold below, in which is the offset-mounted heat valve. As in most installations of this type, the heat valve spindle is parallel to the crankshaft.

The bi-metal thermostat spring is mounted on the front end of the protruding heat valve spindle, but is not enclosed by the small, pressed steel cover that is often employed with this form of device to shield it from fan draught. On the rear end of the spindle is mounted the usual counterweight.

The exhaust manifold is of conventional four port-branch design, the down-pipe leading off from the centre of the system. A small expansion box is fitted just to the rear of the back axle; from it, the exhaust gases are led into the left-hand side of the exhaust silencer, which is mounted transversely at the extreme rear of the car. The tail pipe is taken from the right-hand side of the silencer and discharges through an orifice in the over-rider of the rear bumper.

*The S.U., twin horizontal carburettor and the air silencer installation on the B.M.C. Series C engine of the Riley Two-Point-Six car*



Mixture is supplied by a single Zenith 34-VN carburettor, one of the recently introduced short downdraught units. Only 4¼ in high, this instrument incorporates the Zenith suction-operated air bleed device for economical cruising, together with an acceleration pump. By means of an ingenious quick-change adjustment device, the length of the acceleration pump stroke, and consequently the volume of discharge, can be altered in a moment without the use of a tool of any kind. The formation of vapour within the carburettor is avoided by suspending the emulsion block and metering jets in the fuel in the float chamber. Cold starting is assisted by a conventional offset-mounted strangler valve with a fast-idle linkage which opens the throttle a pre-determined amount when the strangler is fully closed. An A.C. mechanical fuel pump, on the right-hand side at the rear of the engine crankcase, draws fuel from the tank below the floor of the boot. The ingoing air is filtered by a large A.C., vertical oil bath air filter, connected to a circular, domed air-intake on top of the carburettor. An unusual feature of the support for the air filter is the employment of brackets bolted to bosses on the exhaust manifold.

**Six-cylinder engines**

In the new Vauxhall Velox and Cresta power unit, alternate inlet and exhaust porting is employed. On the earlier Velox engine, the induction manifold was of the three port-branch design, in which each branch fed three sets of siamesed inlet valve ports, while cylinders 2 and 3, and 4 and 5 discharged into siamesed exhaust ports, numbers 1 and 6 exhaust ports being separate. However, on the new engine, all the ports are separate. As before, the ports at the extreme ends are for the exhaust. Next come the inlet ports of cylinders 1 and 6; inboard of these are the exhaust ports of 2 and 5; then there are the inlet ports of 2 and 5, followed by the exhaust ports of cylinders 3 and 4; this leaves the two adjacent inlet ports of 3 and 4 with no exhaust port between them. Such an arrangement should give longer life to the exhaust valves, and more satisfactory temperature gradients throughout the cylinder head casting. Also, better breathing is obtainable with single ports. The diameter of the inlet valves has been increased from 1·375 in in the earlier models to 1·437 in in the latest one, and the inlet valve porting has been improved.

As in the case of the previous Velox engine, the induction and exhaust manifolds are on the left-hand side, the induction being above the exhaust. A single, Zenith 34-VNT downdraught carburettor is mounted on the six port-branch induction manifold which, like that of the Victor, is of D-section. The two gallery tracts slope up sharply from the riser well, the front gallery levelling off and the rear one falling slightly on account of the rather pronounced angle of installation of the engine in the frame. All the port-branches leave the gallery tracts at right angles. Following earlier Vauxhall practice, the riser T-junction is jacketed and fed with hot exhaust gas from the thermostatically-controlled valve in the housing on the exhaust manifold below. The heat valve spindle is parallel to the crankshaft; it has a thermostat coil spring at its front end and a counterweight at the rear end. As usual, the down-pipe is taken from the centre of the exhaust manifold.

The 34-VNT Zenith carburettor is basically the same as the 34-VN unit introduced on the Vauxhall models last year, but the design now incorporates a hot-air type thermostat,

automatic choke unit. This VN type carburettor differs from the previous Zenith models in that its height is small so that it is more easily accommodated under the low bonnet-line; the arrangement of the emulsion system is also different. On the V-type carburettors, the emulsion block is attached outside the float chamber and fits into a recess at the side of the main venturi. On the 34-VN and VNT models, the emulsion block is fitted inside the float chamber and is thus immersed in fuel. The thermal conduction path is, therefore, longer, so the emulsion system is kept at a lower temperature. These features help to suppress vapour formation. As on the Victor, an acceleration pump and economy system of the variable air bleed pattern are incorporated.

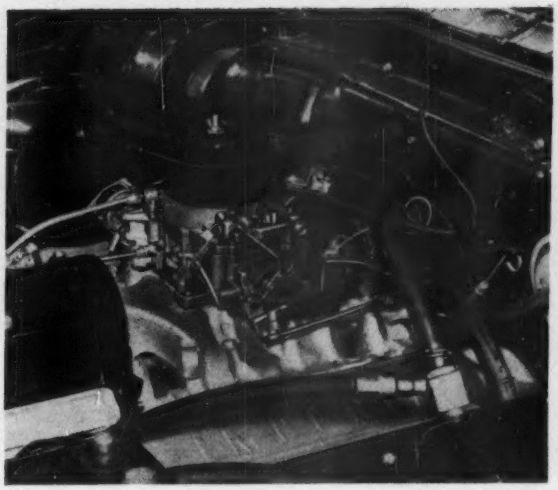
In general, the automatic choke system follows the conventional American design practice, the thermostat spring being a bi-metal, coiled element in a chamber attached to the top of the carburettor, at the side of the air intake. The inner end of the thermostat spring is fixed, while the outer end is linked to the strangler spindle in such a manner that when cold, the spring holds the strangler valve closed. From a small metal box, or *stove*, attached to the rear of the exhaust manifold, hot air is drawn through a metal pipe to the thermostat chamber, over the thermostat spring and thence through passages in the carburettor into the engine. Under the influence of the hot air passing over it, the thermostat spring gradually loses its tension and permits the strangler valve to move to the fully open position.

As with all automatic choke designs, a vacuum piston is incorporated. This piston is linked to the strangler valve in such a manner that as soon as the engine fires, the strangler valve is opened a predetermined amount. A fast-idle linkage ensures that the throttle is opened the correct amount for cold starting and warm-up. A novel feature of the design is the inner *hot chamber*, incorporated to prevent the thermostat spring from cooling off too soon after the engine has been stopped. The thermostat spring is enclosed by a thick metal cup, which is insulated from heat loss to the outer chamber by an outer cover of heat insulating material and an annular air space. In operation, the hot air is drawn over the outer hot chamber before passing through holes into the inner chamber.

The fuel tank is located fairly high up under the parcel shelf, at the rear of the car, and fuel is supplied to the carburettor by means of an A.C. mechanical fuel pump on the right-hand side of the engine crankcase. A circular, pan-shaped air cleaner surmounts the carburettor intake. It has a long tapering silencer tube projecting forwards.

After a lapse of some twenty years, a Riley car is again equipped with a six-cylinder engine. It is the Two-Point-Six model, in which the B.M.C., Series C power unit is employed. This unit is a version of the six-cylinder engine which, in various forms, is fitted in the Austin A95 Westminster, the A105 and the Wolseley Six-Ninety. In the Riley installation, twin S.U. horizontal carburettors are bolted to the left-hand side of the cylinder head, and feed the long induction gallery, which runs the length of the head. This gallery, which is of circular cross section, is cored in the angle between the top and the left-hand side of the head.

An unusual feature of this design is that several of the holding-down studs for the head pass vertically through the gallery tract. The carburettors are so spaced along the tract that their ports are opposite the blank portions of the wall of the gallery between the inlet valve ports of numbers 2 and 3, and 4 and 5 cylinders. All six individual inlet valve ports fall at a steep angle to the inlet valve, and are circular in cross section. Following the usual practice with this form of induction system, the main gallery tract is divided in the middle by a partition in which there is a balance orifice. This small balance orifice is approximately $\frac{1}{2}$ in diameter.



*A squat, compound four-barrel carburettor, with an automatic choke, is installed on the V-eight unit of the Chrysler Imperial Le-Baron*

The exhaust manifold system, also on the left-hand side of the engine, is composed of two separate manifold castings, each having three port-branches, as on other versions of this engine. These two castings merge into a single pipe leading to the exhaust silencer behind the rear axle.

In both carburettors, the float chambers are at the front and are shielded, from heat radiated from the exhaust manifolds, by a metal deflector plate. A single, Vokes air silencer, of the long cylindrical pattern, with the tapered air entry at the front, is mounted above the left-hand side of the rocker cover. It is connected to the carburettors by an inverted Y-shaped aluminium casting, the arms of which fit over the air intakes of the carburettors.

On the Aston-Martin DBIII, the cylinder head has been redesigned to accommodate larger inlet valves and higher lifts for the inlet and exhaust valves; there is also a modified induction system, which is now fed by two S.U. horizontal carburettors, one on each of the two separate induction manifolds on the right-hand side of the engine. Each manifold feeds three cylinders, and a balance orifice is incorporated between them. The carburettor outlets are between the inlet ports of numbers 2 and 3, and 4 and 5 cylinders. In both carburettors, the float chambers are at the front. The induction manifolds are jacketed to accommodate the flow of engine coolant to heat the mixture. Small individual air silencers are fitted to each carburettor. Fuel is supplied by means of an S.U. electric fuel pump, mounted on the left-hand side of the bulkhead.

**American designs**

The general arrangement of induction and carburation systems on American V-eight engines settled down long ago to the now conventional design of the cross-over induction tracts in a single, large manifold casting, with the exhaust gas hot-spot jacket fed by gas flow from one exhaust manifold across to the other. However, the new Edsel introduces something different. For the first time a modern American V-eight engine has been produced without an exhaust hot-spot, a coolant jacket being incorporated instead. Evidently the Ford organization have considered carefully the well-known disadvantages associated with coolant-heated hot-spots, for they have not only introduced a three-stage, thermostatically-controlled coolant regulator, but have also incorporated a thermostatic control in the air intake to the carburettor. This latter feature is a most useful adjunct to a coolant-heated induction system of any type of engine.

*On the Edsel, the air intake temperature is regulated by a thermostatically-controlled flap valve in the fabricated rectangular section air passage that leads into the large, shallow disc-like air cleaner*

On the Edsel, the induction gallery arrangement follows the approved style, the tracts being fed by a Holley, four-barrel compound carburettor. The three-stage thermostat is employed to improve the warm-up rate of the coolant-heated hot-spot. After the engine is started from cold, the first stage restricts the flow of coolant to the circuit within the cylinder head and induction hot-spot only. As the engine warms up, the thermostat brings the cylinder block into the circulation; and, finally, the third stage permits coolant to flow through the radiator.

In addition, hot air is fed to the carburettor intake when the engine is cold. A sheet metal muff covers a portion of the left-hand exhaust manifold; from this muff, a large diameter, metal pipe leads upwards to the air intake of the very large, shallow disc-like air cleaner that surmounts the carburettor. Inside the connecting pipe is a metal flap valve, thermostatically-controlled to supply hot air when the engine is cold, and cool air when it is hot. It will be recalled that a similar scheme was introduced on the Lincoln a few years ago.

The new Packard Hawk installation is similar in many respects to that of the Studebaker Golden Hawk exhibited at the Motor Show last year. A 4,740 cm³, V-eight engine, fitted with the McCulloch supercharger, is employed. Driven by a belt, the supercharger incorporates an automatically variable drive system, by means of which the blower pressure is regulated in proportion to the throttle opening. A boost of 5 lb/in² is obtained at maximum power. The Stromberg, four-barrel compound carburettor is completely enclosed inside a box-like casting, which is sealed on to the induction manifold. Thus, the supercharger is upstream of the carburettor, as opposed to the more usual arrangement of installing the supercharger between the carburettor and the engine. The peak b.h.p. claimed is 275 at 4,800 r.p.m.

**Petrol injection**

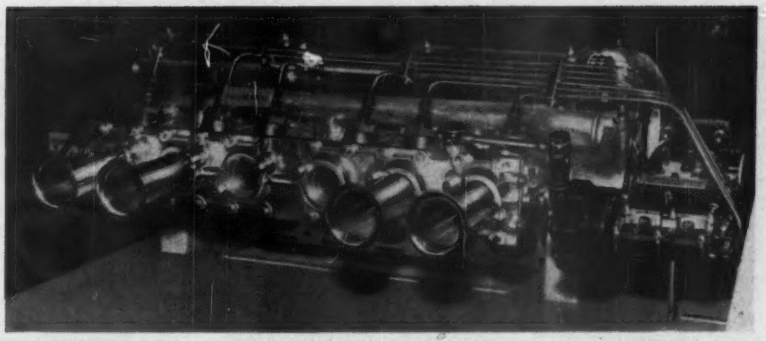
Of all the cars exhibited, only two were equipped with petrol injection, both being Mercedes-Benz models. One is the 300SL, which was first exhibited at the Motor Show in 1954. In this model, the original Bosche direct injection equipment was installed again this year. A diesel type, multi-cylinder jerk pump delivers petrol to the injection nozzles in the top of the cylinder block, injection being effected directly into the combustion space. The engine is mounted in an inclined position in the frame, as viewed from the front, so that the cylinder head lies to the right in the engine compartment. The large induction manifold gallery is on the left, and the six, long induction port-branches sweep across the engine to the inlet valve ports in the head.

On the model 300, however, the engine is installed vertically, in the conventional manner, and the injection nozzles, instead of supplying fuel directly into the combustion space, now inject into the induction port-branch tracts, close to the cylinder head. This is in conformity with the general trend with regard to petrol injection practice both in Europe and America. An injection pump of a type similar to that of the 300SL is employed. The main induction gallery is now on the right-hand side of the engine compartment, and the tract is of circular cross section and of large area. A relatively high position has been chosen for the induction manifold, and the six port-branches curve down from the gallery tract inwards to the inlet valve ports in the head. The branches are arranged in three pairs, the tracts of each pair being very close together.

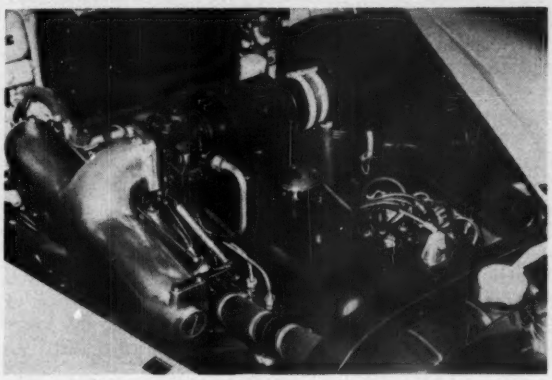
There is an oil bath air cleaner on the left-hand side of the engine. Interposed between the air cleaner and the induction gallery intake is the housing for the single throttle valve assembly. On the suction side of the throttle valve, a tube for the mixture control device is taken from this housing. This mixture control device consists of a diaphragm and spring assembly, which, under the influence of the induction manifold depression acting through the medium of a rack and pinion system in the fuel pump, regulates the stroke of the injection plungers and consequently the quantity of fuel passed to the nozzles. Also incorporated in the design are complicated controls for regulating the fuel supply to the engine, according to changes in engine coolant temperature, as well as in the intake air density, and temperature.

*The McCulloch supercharger, with an automatically variable drive, installed on the Packard Hawk is the same as that shown last year on the Studebaker Golden Hawk*

*Right: Lucas petrol injection system, as fitted to the Jaguar 3·4 litre racing engine*



*Below: The single throttle valve assembly and induction manifold used with the petrol injection system on the Mercedes-Benz 300*



There is, in addition, an electrically-operated fuel supply pump. This is provided not only to ensure a positive supply of fuel at all times, but also to prevent the formation of vapour lock in hot weather. It is actuated automatically by engine oil temperature, but can also be operated at will by a separate switch. An automatic system for starting from cold, controlled by a thermostat sensitive to the temperature of the coolant, permits a rich mixture to be metered by the injection pump. As the engine warms up, the starting device is automatically cut out by the thermostat, the operation being not unlike that of an automatic choke.

An interesting exhibit on the Lucas stand was a cylinder head of the Jaguar 3·4 litre engine, equipped with the Lucas petrol injection system. While full details of the system are not yet available, it is common knowledge that Jaguar sports cars entered in 1956 for the races at Nurburgring, Sebring, Reims and Le Mans were equipped with the Lucas system.

Basically, the fuel system comprises a supply line, pressurized at approximately 100 lb/in², feeding fuel through a metering unit to each cylinder in turn. This supply can be pressurized either by an engine-driven pump or by a separate electrically-driven pump, the latter being preferable although possibly slightly more expensive. The components of the Lucas six cylinder petrol injection installation comprise an electrically-driven high pressure fuel pump incorporating the main filter, a secondary filter, a metering distributor and six injector nozzles.

Petrol is drawn from an anti-surge well in the base of the tank, and is filtered before entering the pump. It is then passed under pressure through the secondary filter to the distributor. In this unit, the petrol is metered and passed in a timed sequence to each nozzle in turn. The function of the nozzles is to inject the fuel as a very fine spray into the ingoing air streams. A mixture control device, mounted on the metering distributor, is connected pneumatically with a balance pipe joining each induction tract. This device regulates the amount of petrol injected, so that the fuel delivery is proportional to the induction air pressure.

The fuel supply pump is preferably fitted either in or near to the tank, so that its operation is unaffected by heat radiated from the engine. It consists of a simple, gear type pump, driven by a built-in, series-wound motor. A relief valve regulates the pressure to 100 lb/in², surplus fuel being returned to the tank. An advantage of this system is that the fuel in all the pipes, from the tank to the injection nozzles and engine, is pressurized as soon as the ignition switch is turned on. This effectively prevents any trouble due to vapour lock, since any pockets of vapour formed while the vehicle is standing are collapsed immediately.

Incorporated in the metering distributor is a small shuttle moving axially between two stops in the lapped bore of a hardened steel rotor. This movement is effected by the pressure of the fuel in the feed pipe from the supply pump. The rotor, which is carried in a stationary cast iron sleeve, is driven by the engine. At each end of the rotor and its housing-sleeve, there are radial ports drilled in such a way that, as the rotor revolves, first the port at one end is opened to the pressure feed line, while that at the other end is connected to the delivery line serving one of the cylinders; then as the rotor turns further, the pressure feed line is connected to what was previously the delivery end, while the opposite end is opened to the delivery line to another cylinder. Thus the chambers at each end of the shuttle are alternately filled and emptied as the shuttle moves to and fro between the two stops: at each movement, the displaced fuel is injected into the appropriate cylinder. The quantity of fuel injected is equal to the area of the bore, in which the shuttle moves, multiplied by the travel between the two stops; thus an identical quantity of fuel is injected into each of the cylinders in turn. Control of the quantity injected is effected by making one of these stops movable.

In order to vary the quantity of fuel injected per stroke and to keep the fuel:air ratio substantially constant over the working range, a mixture control device is incorporated. It consists of a piston, subject to the induction pressure in the manifold or at the inlet valve, working against a spring and regulating the position of the control wedge, against which abuts a movable stop in the distributor. The wedge is profiled in a way such that the amount of fuel injected per stroke is proportional to the absolute pressure in the manifold; thus, a constant fuel:air ratio is maintained.

In the high-speed six-cylinder metering unit developed for the Jaguar engines, the principle of operation is the same, but the mechanism is more elaborate because a double-rotor unit is employed. Each rotor, which serves three cylinders, contains two shuttles and has three double inlet-ports and three single outlet-ports. The successive opening and closing of ports in this unit is effected by driving the rotors at one-quarter engine speed. A datum adjuster is incorporated for making trimming adjustment to the mixture ratio. As a further refinement, adjustment devices can be incorporated to correct for atmospheric pressure and temperature variations, although in many cases these are unnecessary.

To provide for lubrication between the rotor and the cast

iron sleeve, there is an oil pump in the drive housing. This pump supplies the oil at a pressure slightly higher than that of the fuel. Therefore, it not only provides the necessary lubricating film, but also serves to prevent fuel leakage along the sleeve. In addition, oil is ducted to lubricate the shuttles.

Each injection corresponds to an induction stroke of the engine and consequently, the second rotor must provide injections phased 120 deg of crankshaft rotation after each injection effected by the first rotor. Petrol enters the metering distributor by a single inlet union and thence through the twin ports in each rotor to the appropriate shuttle chamber. It is then displaced, by the shuttle movements, through each of the six single outlet ports in turn to the injectors.

An injector nozzle comprises a spring-loaded poppet valve arranged to lift when the fuel pressure reaches a value of about 50 lb/in², and to spray atomized fuel upstream in each inlet port. Adequate mixing between the fuel droplets and the air stream is obtained by this arrangement, because the relative velocity between the fuel droplets and the air is high.

One of the chief advantages of a petrol injection system is that it makes possible the use of a manifold designed solely to carry a maximum flow of air to the cylinders. In the Lucas design of intake system used on Jaguar cars, the air intake is completely free of obstruction when the throttle is fully open; there is neither a choke tube nor a throttle spindle and plate assembly.

The throttle is a steel plate extending the full length of the cylinder block. This plate is carried on rollers, so that it can slide freely fore and aft. It is actuated by a rack-and-pinion device coupled to the accelerator pedal. The plate has as many holes in it as there are engine cylinders. These holes are of the same diameter as the induction tracts and are so spaced that endwise movement of the plate regulates the size of the throttle apertures. By this method of air control, perfect throttle synchronization at all cylinders can be obtained.

Tuning to give a ram effect at certain speeds, is effected in this design by choice of both diameter and length of the intake trumpets. The performance characteristics of the engine can be altered at will, by fitting different trumpets, to make it suitable, for example, for a short twisty circuit where maximum acceleration through the gears is required, or a long fast circuit where maximum power has to be developed at high car-speeds.

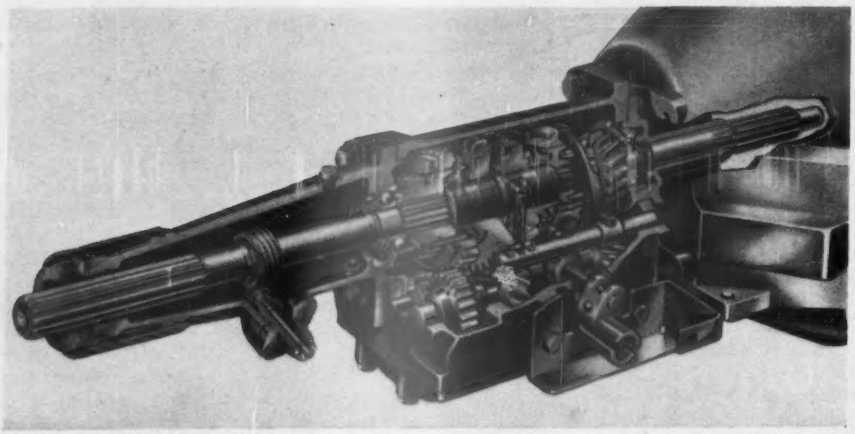
While it would appear that the economics of the popular-priced car production would prohibit petrol injection from being employed as a standard fuel metering system in place of the ordinary carburettor, it might possibly be considered for application to the more expensive type of V-eight engine. This might come about, not because an injection system is necessarily inherently better as a metering device than the modern carburettor, but because the lowering of the bonnet may render even the squat, four-barrel carburettor unsuitable. From this point of view, it can be seen that even on conventional four- and six-cylinder engines there may well be a revival of the horizontal carburettor as a replacement of the downdraught type, should bonnet lines become lower still, in conformity with the trend in the United States.

# Transmissions

## *Automatic and Semi-Automatic Systems Being Developed for Application to the Medium and Smaller Size Saloon Cars Respectively*

WHILE the single-dry-plate clutch and synchromesh gearbox giving either three or four forward ratios may still be regarded as being the normal transmission, the tendency noted a year ago for some measure of automaticity to be adopted is this year even more marked. By reason of its comparative complexity and higher cost, the fully automatic transmission is naturally only standardized on some of the larger and more expensive cars, but it is being offered as an optional extra on many others, including several in the medium size and price bracket. At the same time the customer demand for two-pedal control is not restricted to large cars, and accordingly two-pedal control is being made available on many of the medium size cars and also as an optional extra on some of the small size. Broadly speaking, it can be said that fully automatic transmission is being applied to the top of the range of car sizes, with a tendency to spread down to the middle of the range, while semi-automatic transmission is being applied to the middle of the range and tends to spread down to the lower end.

As regards the normal types of transmission there is little



*This three-speed gearbox for the Vauxhall Velox and Cresta, like that for the Victor, has synchromesh for all three forward speeds*

of note to record in the single-dry-plate clutch, which has been developed over many years into a smooth-acting, durable and reliable unit. Hydraulic actuation is becoming general, by reason of its simplicity and suitability for accommodating the movement of the power unit on its flexible mountings. Mechanical linkage between a unit liable to movement and a fixed clutch pedal is apt to be complicated and tends to wear at the pivots.

Friction clutches actuated by centrifugal force, or by servo mechanisms, are employed in some of the semi-automatic transmissions, and as such are dealt with later. There are also the Ferlec electro-magnetic clutch optional on the Renault 4 CV and Dauphine, and the Smiths electro-magnetic-powder clutch used on the Isetta, both of which likewise form a part of semi-automatic transmissions.

In gearboxes perhaps the most significant move is the provision of synchromesh mechanism for first gear. The new Vauxhalls—Victor, Velox and Cresta—have synchromesh for first gear, as well as for second and top, and this undoubtedly contributes to ease of driving, particularly in congested traffic and in mountainous districts.

With a four-speed box, in which first is more in the nature of an emergency low gear, the need for synchromesh on all ratios is less pronounced. Nevertheless it is provided on the Borgward, and David Brown Industries Ltd. have introduced the new model S.432 gearbox with synchromesh for all four ratios. This box is compact in design, and attention has been paid to keeping down the weight by the use of light alloy for the casing and the bellhousing. It is controlled by a short, central lever at the rear of the casing. This casing is well ribbed for strength and cooling. The ratios are 1 : 1, 1·255 : 1, 1·855 : 1, 2·92 : 1 and reverse 2·52 : 1.

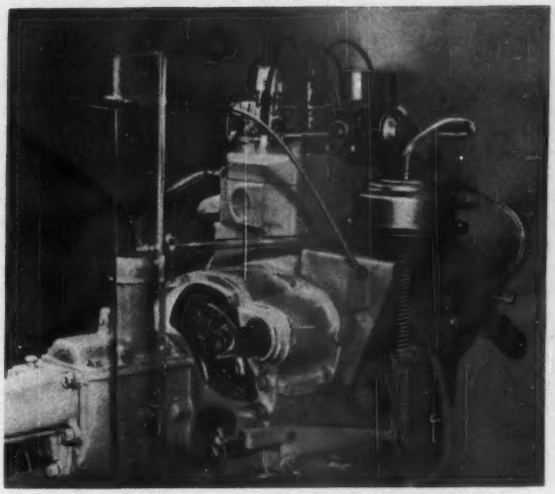
The Pont-A-Mousson gearbox of the Facel Vega also has synchromesh for its four forward ratios and is controlled by a short stiff centrally mounted lever projecting towards the driver at an angle that brings it within very easy reach. There is, in fact, a growing tendency to revert to the central lever, or to a floor-mounted lever on the right, although the steering column control continues to be widely used.

Because of the growing popularity of overdrives, there is wide diversity in the number of gears provided. While there are few five-speed gearboxes, examples include the David Brown CG 537, which incorporates the rear axle unit, and the Fiat 1900 B, in the Aston Martin DB Mark III an overdrive, which operates on top gear only of its close ratio four-speed gearbox, is an optional feature, and the Standard Vanguard has an overdrive as original equipment to operate on the top and second gears of its three-speed gearbox. Both, therefore, have five forward gear ratios. In the case of the Aston Martin the purpose of the overdrive is to give a high gear for fast cruising at low engine r.p.m., and in view of the close ratios of the gearbox there would be little or no point in the overdrive operating on third and second gears. The overdrive ratio is 2·93 : 1, and the gearbox overall ratios are 3·77 : 1, 5·01 : 1, 7·46 : 1 and 11·0 : 1.

With the Vanguard gearbox the overall ratios are more widely spaced, 4·3 : 1, 7·18 : 1, and 15·22 : 1, and the overdrive provides a high ratio of 3·35 : 1 and a very useful ratio of 5·6 : 1 approximately mid-way between the normal top and second gears.

When overdrive is made available as an optional extra, it is usual for manufacturers to provide a lower final drive ratio to go with it. The Jaguar Mark VIII may be cited as a representative case: the normal final drive ratio is 4·27 : 1, but the final drive ratio, if an overdrive is fitted, is 4·55 : 1.

An overdrive that operates on all three ratios of a three-speed box can provide six extremely useful ratios. Taking as an example the Ford Consul, on which overdrive is an optional extra, the overall ratios from which the driver may choose are (3·11 : 1), 4·11 : 1, (5·11 : 1), 6·75 : 1, (8·834 : 1) and 11·67 : 1, the overdrive ratios being those shown in brackets. The upper three ratios are sufficiently far apart for all of them to be really useful, and the overdrive first gear ratio of 8·834 : 1 forms a very useful step between the normal first and second gears.



*Newtondrive centrifugal clutch, with servo withdrawal, and the control unit, which is fitted as an optional extra to the Ford engine shown here*

On the Sunbeam Rapier, overdrive is standardized and operates on top and third gears, thus making six overall ratios available as follows (3·95 : 1), 5·22 : 1, (5·891 : 1), 7·788 : 1, 12·905 : 1 and 16·642 : 1. On the Triumph TR3, with the overdrive operative on top, third and second gears, the driver has, of course, seven ratios available as follows:—(3·03 : 1), 3·7 : 1, (4·02 : 1), 4·9 : 1, (6·07 : 1), 7·4 : 1 and 12·5 : 1. Thus, overdrive third is rather close to normal top but nevertheless occasions do arise, albeit but seldom, when the overdrive third ratio gives just that little extra urge, bearing in mind the nature of the car and its frequent use on high-speed rallies involving fast hill climbing.

Both the Borg-Warner and Laycock-de-Normanville overdrives have already been reviewed in detail and are now well known. The Laycock-de-Normanville Type D unit was developed for cars with engines of less than 1½ litres capacity and has won ready acceptance on the smaller cars. With the Lucas automatic overdrive control, sensitive to speed and throttle, the driver is relieved of the decision whether or not to engage overdrive, but he can engage direct drive when he wishes, irrespective of road speed, by a kick-down depression of the throttle pedal.

Of the semi-automatic transmissions it may be said that the broad principle is an automatic clutch and an electric control, the switch being incorporated in the gear lever so that the synchronization of clutch and throttle is effected at the moment of changing gear. In the Newtondrive two-pedal control, available as an extra on certain Ford models, the Newton centrifugal clutch, a servo withdrawal unit, and a control valve are used. In the gear lever is an electric switch operated by a push button in the knob. The Standrive of the Standard Ten is similar and incorporates Newtondrive patents.

A feature of the clutch is that it has only one set of springs, which are ingeniously arranged so that at a certain point during disengagement, they cease to be presser springs and take over the function of withdrawal springs. This makes it possible to use lighter weights and to arrange the cut-in speeds according to requirements. The unit fits directly on to the flat face of the flywheel, in approximately the same area as a normal clutch. It takes up the drive as engine

r.p.m. increase and disengages as engine speed drops below a critical speed, which is normally about 800 r.p.m.

The vacuum servo diaphragm operates the clutch during gear changes and also during idling: thus there are two independent means of clutch withdrawal. Linkage connecting the control unit to the throttle pedal ensures that clutch engagement is proportional to throttle opening. Another interconnection with the choke control automatically disengages the clutch when the choke is in use, because in these circumstances the engine idling speed would otherwise be in excess of the disengagement speed of the clutch. The control unit has two solenoids, one of which is energized, as engine speed increases, by current from the dynamo through the cut-out, and so admits air to the clutch servo to allow clutch engagement. The other solenoid is energized from the battery when the gear lever switch is closed as the driver changes gear. This admits vacuum to the servo and disengages the clutch. During gear changes, the engine speed is held above the critical 800 r.p.m. by a throttle diaphragm which also effects synchronization for "foot off" changes. For tow-starting or for using the engine as a parking brake, a gear is selected and a lever connected to the clutch disengaging mechanism is pulled and released, with the engine at rest; this locks the clutch.

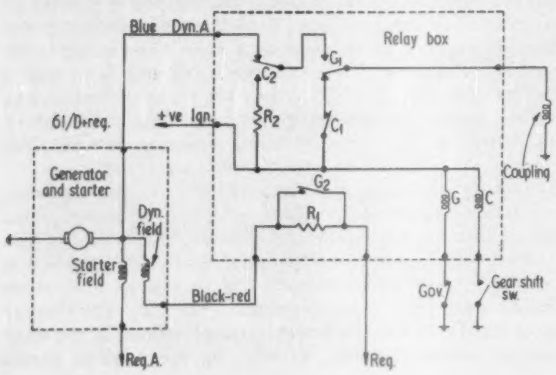
Three units, clutch, control unit and clutch servo are also used in the Manumatic two-pedal control system. Operation of the units is controlled by two switches, the gear lever switch and the synchronizer switch built into the clutch and making contact when the engine speed is incorrect. Signals from these two switches pass to the control unit, which by means of three vacuum servo units automatically withdraws the clutch, controls the throttle during a gear change and prevents re-engagement of the clutch until engine speed is correct. The two vacuum servos for closing and opening the throttle are contained in the control unit.

Two-pedal control is also provided by the Ferlec electromagnetic friction clutch in conjunction with a control unit and a switch incorporated in the gear lever knob. For starting from rest, the clutch is energized by the dynamo current, which increases with engine speed, and so gives progressive engagement. For changing gear the current is interrupted by the gear lever switch, thus allowing the clutch to disengage.

The Selectroshift system produced by Smiths Motor Accessories Ltd. gives two-pedal control by means of the unusual form of electro-magnetic coupling, in which a magnetic powder transmits the drive from the driving to driven member. Originally patented in the United States by Jacob Rabinow, and developed by the Eaton Manufacturing Co., the coupling has been further developed and to some extent simplified by Smiths.

In an earlier model, the excitation coil revolved with the driving or field member in which it was housed, necessitating slip rings for current conduction, but in the latest form the coil is fitted in a stationary field member surrounding the rotating field member. This change has been effected primarily to reduce the inertia of the flywheel assembly, but it also simplifies the connections to the winding. The rotating output member is attached to the gearbox mainshaft, and between the driving and driven members, there is an air gap in which is a quantity of fine magnetic powder. When current passes through the coil, a magnetic flux is set up in the iron stationary field member, the flywheel, and through the magnetic powder to the driven member, back through the magnetic powder to the flywheel and to the stationary field member.

*Diagrammatic illustration of the electric control circuit of the Smiths simplified Selectroshift system, as developed for the miniature cars*




As soon as the engine is started, current passes from the dynamo to the excitation coil, and as the voltage rises with increasing speed, the magnetic field progressively binds the magnetic powder, so that the drive is taken up smoothly. At 10 m.p.h., a speed sensitive governor actuates contacts so that current is supplied from the battery to the excitation coil. A switch incorporated in the gear lever interrupts the coil circuit and frees the clutch during gear changing.

The latest development with regard to the Selectroshift system is its application to the Isetta 300. Noteworthy features of this application are the simplification of the control circuit and the small dimensions of the output member of the coupling. Limitation of the size and inertia of the output component has made possible rapid upwards and downwards changes with a crash-type gearbox.

As can be seen from the accompanying illustration of the control circuit, the main components of the system are: the governor, gear shift lever and switch, and the control box. The governor incorporates a speed-sensitive switch and is driven from the speedometer drive off-take on the gearbox, the speedometer being cable-driven in the usual manner. This governor is responsive to road speed and its function is to break an electric circuit when the speed increases to a certain value: this cuts out the dynamo and introduces the battery as the source of current supply to the coupling. The unit has been designed in such a way that its inherent hysteresis characteristics ensure that when the vehicle decelerates, the contacts are made at a road speed lower than that at which they were broken.

A switch is installed in the gear shift lever in such a manner that contact is made whenever a load is applied to the knob of the lever. This contact operates relays which in turn cause the current to the coupling to be interrupted during gear shifts. There are only two relays in this system, and both are housed in the control box, which is mounted inside the car. Each of the relays has double-pole change-over contacts and two resistances. The electrical connections in the control box are taken out to a multi-pin socket; and a wiring loom with a multi-pin plug connects the control box to the coupling, dynamo, gear lever switch and governor.

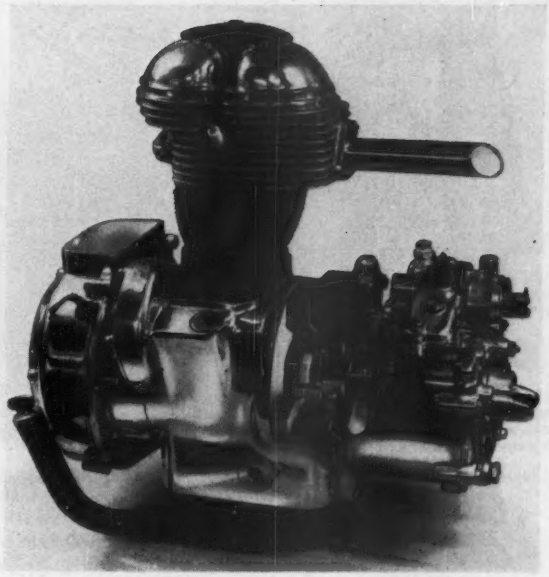
When the ignition is switched on, the G relay coil is energized through the governor contact. This causes the $G_1$ contact to connect the clutch coil to the dynamo output terminal. At the same time contact $G_2$ is broken, thus inserting resistance $R_1$ into the dynamo field circuit: this modifies the dynamo output voltage to obtain a suitable dyanamo voltage-speed characteristic to give a smooth take-up of the clutch during acceleration from rest. The engine is started with the gear shift lever in its neutral position.

First gear is engaged by movement of the selector lever. The action of moving the lever energizes the C relay through the gear shift lever switch. Contact $C_1$ is broken—at this stage there is no feed through this part of the circuit—and contact $C_2$ changes over so that a very small current is supplied from the battery through resistance $R_2$ to the coupling, to create slight drag. This drag causes slight

rotation of the gearbox input shaft, so that the first gear or reverse gear dogs can be engaged without difficulty when the vehicle is at rest. Before this feature was incorporated, difficulty was sometimes experienced in engaging first and reverse gears, with the vehicle at rest, owing to the gears being out of alignment. When first gear is engaged, the gear shift lever is released and the modified dynamo output current is fed to the coupling coil.

When the engine is idling, the small voltage from the generator is not sufficient to transmit appreciable torque and so creep is not experienced. As the accelerator is depressed and the engine speed rises, the dynamo voltage, and therefore the coupling torque capacity, increases progressively to give a smooth take-off from rest. Ultimately the drive becomes solid, and at a road speed of 10 m.p.h., the governor contacts break, de-energizing the G relay. The $G_1$ contact changes over and the coupling is fed with current directly from the battery, through the $C_1$ contact. At the same time, the $G_2$ contact closes and shorts out resistor $R_1$, restoring the dynamo to its normal characteristic for battery charging purposes. Above the road speed at which the governor contact breaks, operation of the gear shift switch completely isolates the clutch coil from current feed and frees the clutch for rapid gear shifts.

When the vehicle is brought to rest, the governor contact is remade at 8 m.p.h. and, as the road speed further decreases, the engine speed is reduced in proportion until the dynamo voltage falls to the point where the clutch disengages. Then, the vehicle stops and the engine is completely freed from the transmission. Thus, even in crash stops in any gear, it is not possible to stall the engine through the medium of the coupling. The current consumption of the coupling is approximately 2 amps, and the additional load on the car electrical system is of the order of 24 watts.



*Noteworthy features of the Selectroshift control, as applied to the Isetta 300, are the simplification of the control circuit, and the small dimensions of the output member of the magnetic particle coupling*

*One of the latest additions to the David Brown range is this Model 5432 gearbox, in which all four forward gears are fitted with synchromesh mechanisms*

Two-pedal control on the Mercedes-Benz types 219 and 220S is given by the Hydrak transmission. This unit consists of a fluid coupling for take-up, a single-dry-plate clutch operated automatically by a vacuum servo unit to break the drive during gear changes, a control unit, and a device on the rear axle to smooth take-up after gear changes.

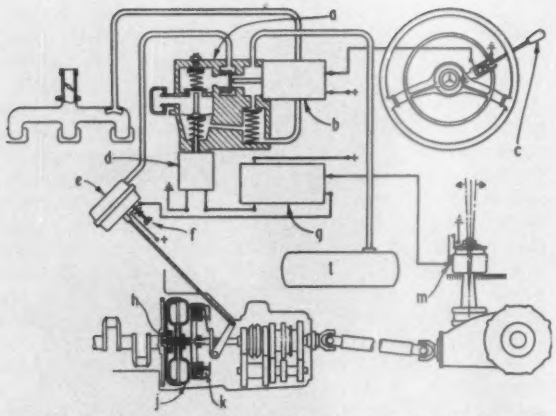
To provide engine braking below the stall point of the fluid coupling which, at 1,600 r.p.m., is comparatively high in order to give swift starting from rest, a free-wheel is mounted between the drive housing of the coupling and the driven member. This is so arranged that it allows the impeller to over-run the driven member, as when the car is stationary with a gear engaged and the engine running, but the driven member cannot over-run the impeller because of the locking action of the free-wheel.

The device on the rear axle consists of a switch in a circuit to the control unit. Fore and aft movement of the axle under driving or over-run torque operates the switch. Thus, this switch constitutes an over-riding control on the valve gear in the unit that governs the clutch servo, and so compensates for differences in speed between engine and axle. The gear lever also incorporates a switch in an electric circuit to the control unit. Movement of the lever to change gear completes the circuit to a solenoid, which in turn opens a valve to admit vacuum to the servo and so withdraws the clutch. There is no interconnection between the gear lever and throttle, however, and gear changes are made by the normal mechanical linkage.

Daimler continue to employ their fluid flywheel and Wilson preselective gearbox transmission on the 3½ litre and 4½ litre models, but the 3½ litre One-O-Four saloon is also available with the Borg-Warner automatic gearbox. Thus Daimler are utilizing the hydraulic coupling in their classic fluid drive transmission, and the hydraulic torque converter in the Borg-Warner automatic transmission.

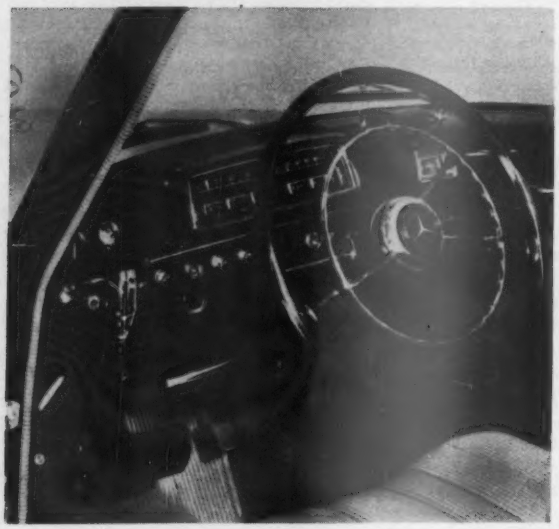
The Hydramatic unit is the only other automatic transmission in production that incorporates a hydraulic coupling. This well known system is now manufactured under licence by Rolls-Royce, and is used on Rolls-Royce, Bentley, Armstrong-Siddeley Sapphire, and Austin Princess IV. It incorporates two epicyclic trains, the drive passing to the first epicyclic train, thence to the coupling, and finally to the second epicyclic, although so far as actual location is concerned, the coupling is in front of the two epicyclic trains. Control of the brake bands and clutches of the epicyclics is effected hydraulically, two oil pumps being used. One pump is responsive to engine speed and the other to propeller shaft speed. An over-riding manual control allows the drive to retain second gear, or third gear within its useful speed range.

It should be noted that the advantage of the layout adopted is the elimination of creep with the engine idling and the car stationary. The drive from the engine is taken through the casing enclosing the fluid coupling, direct to the annulus of the front gear unit. Thence the drive is taken



**a** *control valve*; **b** *actuating solenoid*; **c** *gear shift lever incorporating electrical contacts*; **d** *tension solenoid*; **e** *servo unit*; **f** *limit switch*; **g** *relay*; **h** *free-wheel*; **j** *hydraulic coupling*; **k** *magnetic clutch*; **l** *vacuum reservoir*; **m** *rear axle switch*

*Diagrammatic illustration of the Mercedes-Benz Hydrak transmission*



*Control layout of the Mercedes-Benz 220S with the Hydrak system*

forwards through the planet carrier to the driving torus or impeller, the driven torus transmitting the drive to the sun gear of the rear gear unit.

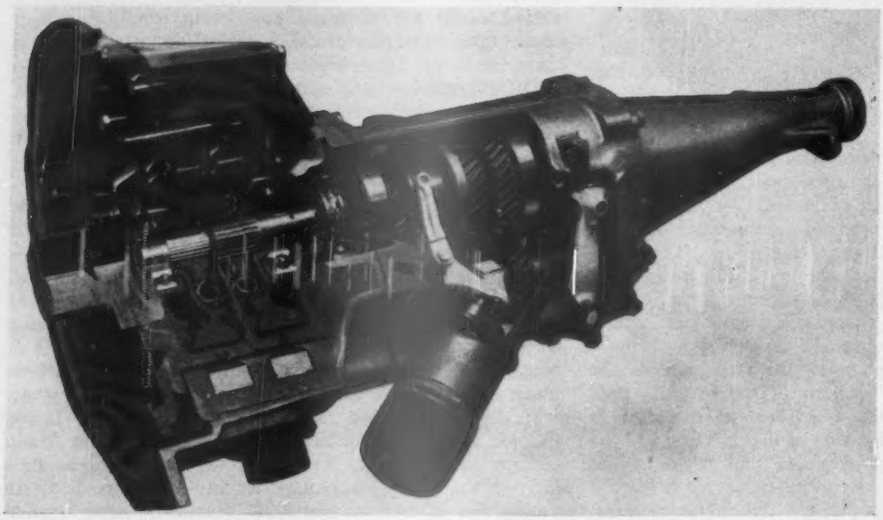
Therefore, when the car is brought to rest, and the gearbox automatically engages first gear, the front gear unit is in reduction. The normal engine idling speed is 400 r.p.m., but since the driving torus is coupled to the planet carrier of the front gear unit it will be driven at reduced speed, about 270 r.p.m., which is below the speed at which the coupling becomes effective.

Another advantage is the division of torque on third and fourth gears, making for greater efficiency. The rear unit is in direct drive but two members of the unit are not directly locked together. The annulus is locked, by the multi-plate clutch, to an extension of the front unit planet carrier, which is driven from the engine through the front unit annulus. At the same time, the rear unit sun gear is directly connected to the driven torus and therefore rotates at the same speed as the rear unit annulus. The effect is that of locking annulus and sun gear together, but only part of the engine torque is subject to loss in the fluid coupling, the remainder of the torque being carried directly through the rear clutch and annulus gear to the output shaft and rear wheels.

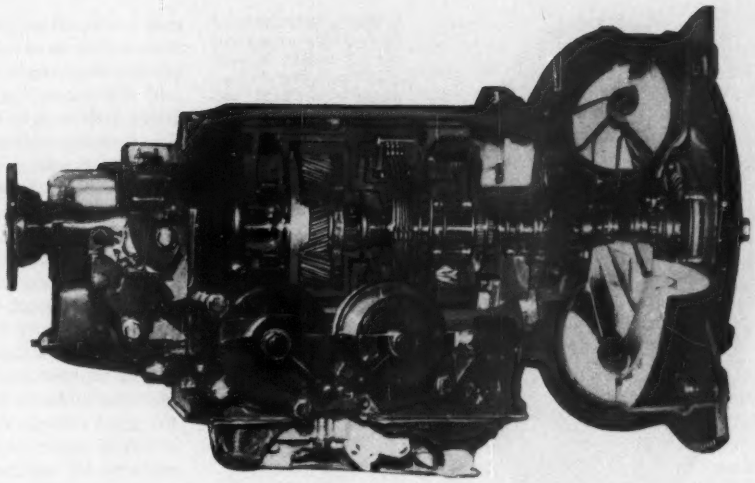
It is interesting to note that on the Bentley Continental, a synchromesh gearbox, with manual control by a right-hand, floor-mounted lever, is optional. In this case the overall gear ratios are 2·92 : 1, 3·55 : 1, 4·51 : 1 and 7·81 : 1. With the automatic transmission, however, the ratios provided are 2·92 : 1, 4·25 : 1, 7·69 : 1 and 11·17 : 1, and it would appear that some limitation is imposed by the space available in epicyclic designs.

The Borg-Warner automatic transmission is now either standardized or optional equipment on a large number of cars in the larger and medium size categories. Briefly, it consists of a three-element fluid torque converter coupled to two epicyclic gear units. These epicyclic units incorporate free-wheels and are controlled hydraulically by band and disc clutches, hydraulic pressure being supplied by two pumps. The stator or reaction member of the converter is connected to the casing through a free-wheel, so that as torque conversion ceases the stator can rotate with the driving and driven torus members; this reduces fluid friction losses, and the converter becomes a fluid coupling.

Three forward ratios and one reverse are provided by the planetary transmission. One of the forward ratios is a direct drive, obtained automatically by a single-plate clutch operated by oil pressure. On the other two ratios, low and intermediate, power flows through the torque converter,



*The Smiths Autoselectric transmission partly sectioned to show the two electro-magnetic powder couplings and the solenoid-actuated dog clutch that engages and disengages the second gear*



*This Borg-Warner automatic transmission is sectioned to show the three-element torque converter, the stator being on a free-wheel*

which has a maximum multiplication of approximately 2 : 1.

Low gear is obtained when both gear units are in reduction, their combined ratio being 2·3 : 1 which, with the torque multiplication of the converter, gives a total multiplication of approximately 4·6 : 1. In the intermediate ratio, the front gear unit rotates as one, and the rear gear set gives a reduction of approximately 1·4 : 1 which, combined with the torque converter, gives a maximum ratio of approximately 2·9 : 1. There is thus a smooth range of torque conversion from 4·6 : 1 to 1·4 : 1 through the automatic transmission. An over-riding control is used in some cases to allow the driver to retain the intermediate range at will.

On the Rover 105R, the Roverdrive transmission is retained. This has four units, a three-element torque converter, coupled in turn to a conventional single-dry-plate clutch, a two-speed and reverse synchromesh gearbox, and a Laycock-de-Normanville fully automatic overdrive. The clutch is operated by a vacuum servo motor controlled by a button switch in the knob of the gear selector lever centrally-positioned on the facia. Thus, positive interruption of the drive is obtained for gear engagement, and changes between low and drive are facilitated. Initially, the converter takes up the drive, and subsequently the automatic overdrive changes between the normal 4·7 : 1 overall ratio and the overdrive overall ratio of 3·62 : 1. The torque converter has a maximum torque multiplication of 2·18 : 1. Low gear is provided for emergencies only, and normal driving is carried out with the gear selector in drive position. Its other positions are neutral, low and reverse.

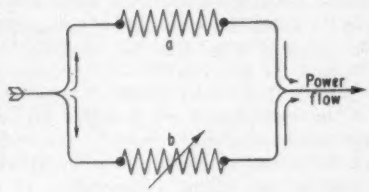
The Renault Transfluide transmission incorporates a three-element fluid torque converter, the stator or reactor being mounted on a free-wheel so that when torque multiplication ceases it can rotate freely and the unit becomes virtually a fluid coupling. Behind this is an electro-magnetic friction clutch, the function of which is to break the drive and obviate the drag during gear changes. The drive is transmitted from the clutch to a three-speed gearbox, which incorporates a device to lock the output shaft for parking. Gear selection is by a lever beneath the steering wheel, and there is an indicator showing six positions, P for parking, R for reverse, N for neutral, E for exceptional or emergency low, M for mountain or an intermediate range, and VR for town-road, that is, the normal driving range.

There remain three other designs not yet applied to production cars, although one has been used with success on heavy vehicles. Of these three, the new positive displacement hydraulic transmission developed experimentally by M.I.R.A. strikes new ground, because it combines a hydrostatic drive, instead of a hydrokinetic drive, with epicyclic gear trains.

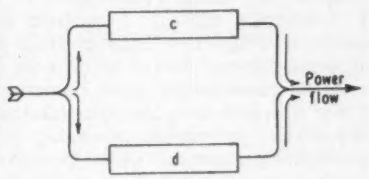
The two hydraulic units are a modified vane-type pump and motor, and they are arranged so that the fluid delivery from each unit can be varied from zero to a maximum. They are placed close together to give minimum flow path lengths and are interconnected so that when one unit is at maximum delivery the other is at zero fluid delivery, and *vice versa*, the relative movement being obtained by means of a control lever. Since, at the two limits of the control valve position one unit is at zero delivery and unable to pass any fluid, the

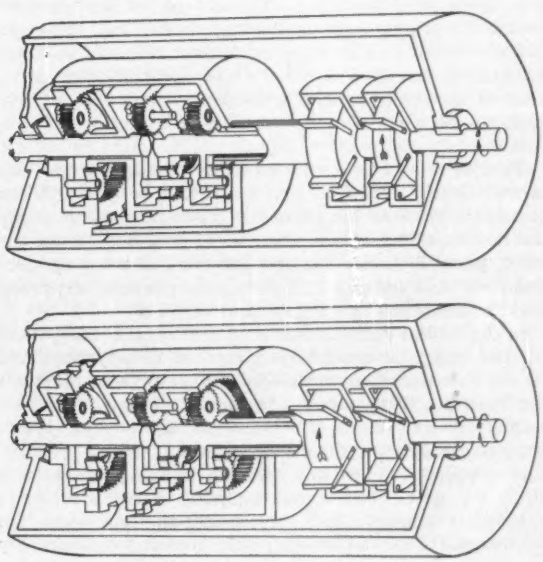
**a** *fixed resistance;* **b** *variable resistance;* **c** *mechanical gears;* **d** *hydraulic variable drive*

*Right: Diagrams showing the electrical analogy and the hydro-mechanical shunt transmission system as used by M.I.R.A.*




*Below: Diagrammatic illustration of the M.I.R.A. transmission. The upper of the two views shows the reverse gear engaged, while in the lower one, overdrive has been selected*



*A typical installation of the Borg-Warner one-way clutch mounted between inner and outer races, which have been sectioned to show the sprag and cage assembly*

other unit, being adjusted to maximum delivery, cannot rotate. Thus at each limit, one rotor is able to spin freely and the other is locked stationary.

Both hydraulic units are mounted concentrically on the input shaft and connected to the two sets of epicyclic gearing, the pump unit being connected to the sun wheel in the first set and the motor unit to the annulus of the second epicyclic train. Thus, when the pump unit is locked, the sun wheel in the front gear set is stopped and an overdrive ratio of 1·4 : 1 is obtained from the drive between the planet carrier and annulus. In this condition, the second epicyclic set is idling.

Similarly, when the hydraulic motor is stopped, the annulus of the second gear set is locked and a low ratio, of 3 : 1 reduction, is obtained from the sun and planet carrier drive of the second epicyclic, while the hydraulic pump and first epicyclic are idling. The values of the limiting ratios, 3 : 1 reduction and 1·4 : 1 overdrive, are applicable to this particular design and different ratios can be obtained by adopting different sizes of gears in the epicyclics.

At all intermediate ratios between 3 : 1 reduction and 1·4 : 1 overdrive both epicyclics transmit part of the power, the relative proportions depending on the torque on the pump and motor units. The proportion of power transmitted by the hydraulic units is much lower than in conventional fluid drives, so that althought the efficiency of the hydraulic circuit is relatively low—in the region of 65 per cent—the overall efficiency is as high as 88 per cent. A governor mechanism, sensitive to throttle opening and road speed, controls the settings of the hydraulic units, so that the gear ratio which gives the most economical engine speed is automatically selected.

Take-up from rest is effected by controlling the pressure in the closed hydraulic circuit through a valve. When pressure is released the pump and motor units rotate freely and no torque can be transmitted. By gradually closing the valve, pressure is restored and the drive is taken up progressively and smoothly. This pressure release valve can itself be controlled by the governor.

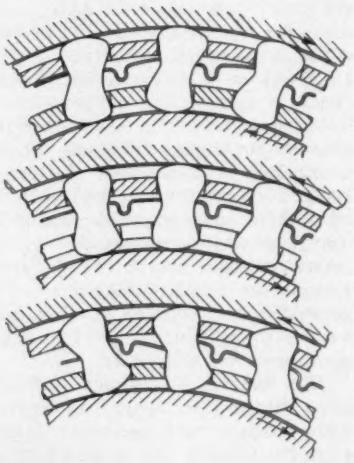
In the Smiths Autoselectric automatic transmission, there are two magnetic powder couplings, as already described for the Selectroshift transmission. Either of these couplings can be engaged separately. The foremost coupling driven member is attached to the solid mainshaft, which passes straight through the three-speed gearbox to the propeller shaft coupling. When this coupling is engaged it gives a direct top gear. The second coupling driven member is attached to a hollow shaft surrounding the mainshaft. On the rear end of the hollow shaft is the constant mesh primary gear. Accordingly, engagement of this coupling causes the drive to be transmitted to the gearbox layshaft, which carries pinions in constant mesh with the gears on the mainshaft.

A dog-clutch member at the rear of the box is manually-controlled to select forward, neutral or reverse positions. For forward movement it locks to the mainshaft the outer member of a free-wheel, which can over-run the first speed gear or be driven by it. Another sliding dog-clutch, in front of the second-speed gear, can be used to lock that gear to the mainshaft. Then the mainshaft runs at a higher speed than in first gear, so the first gear over-runs the free-wheel. When the sliding member is moved forwards, away from the second-speed gear, the latter gear is free to revolve round the mainshaft and the first-speed gear then drives the mainshaft through the medium of the free-wheel. Movement of the sliding member is effected by a solenoid, and a speed-sensitive governor linked mechanically to the throttle control selects the gears automatically.

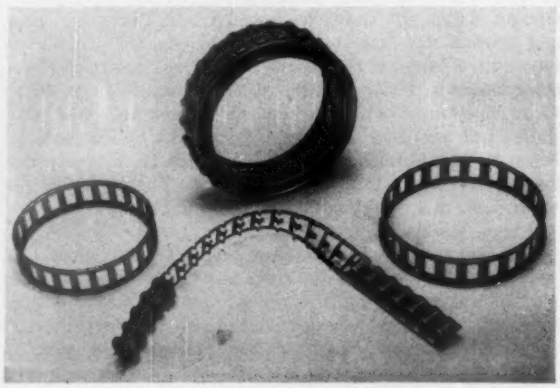
In the Hobbs transmission there are two friction clutches actuated by hydraulic pressure. The driven plate of the primary clutch is carried by an input shaft, and that of the secondary clutch by an input sleeve surrounding the shaft. Power may be transmitted to the shaft or the sleeve, or to both. Between the clutches is a valve body, which carries ring-shaped diaphragms of synthetic rubber so that annular chambers are formed behind the pressure plates of the clutches. Admission of oil under pressure to the annular chambers causes engagement of the clutches. Valves, which are forced inwards by oil pressure and outwards by centrifugal force, govern the admission of oil.

Behind the clutches are three brakes similar, in both construction and operation, to the clutches but requiring no valves. Sleeves forming part of the gear train carry the plates

*Right: These three diagrams show the action of the dumb-bell section sprags of the Borg-Warner one-way clutch. In the upper diagram the clutch is shown free-wheeling, in the centre one it is only partly loaded while the lower one shows it under full load*



*Below: Components of the Borg-Warner one-way sprag type clutch*



of the brakes, so that application of a brake will hold a gear element stationary. The gear unit consists of a planetary train having four sun wheels, which mesh with sets of pinions mounted on spindles carried by a cage. One sun wheel is mounted on the input shaft, one on the input sleeve, one on the output shaft and one on a reaction sleeve.

Incorporated at the front of the transmission are the following components: a pump to deliver oil under pressure when the engine is running, a brake relief valve and a clutch relief valve to maintain suitable pressures for brake and clutch actuation, an automatically operating governor valve, a manually-operated selector valve to direct the oil pressure to the clutches and brakes, and a kick-down valve, which varies the speeds at which the ratios are automatically changed. At the rear, another pump, driven from the output shaft, develops pressure for operating the governor valve, and for actuating clutches and brakes for starting the engine by towing.

This transmission gives four forward speeds and one reverse, the control lever having positions for reverse, neutral, first, second, third and automatic. With the lever selecting automatic, changes are of course made automatically; but each ratio may be manually selected and held by moving the lever to the appropriate position.

The primary clutch is engaged for all forward ratios, and power is transmitted through the input shaft. For first gear the rearmost of the three brakes is applied and holds the gear cage stationary. Power passes from the input shaft sun wheel, through the pinions meshing with it, to the output shaft sun wheel and output shaft.

In changing from first to second gear, the rearmost brake is released and the middle brake of the three is applied. This holds the reaction sun wheel stationary, and reaction is applied through the two sets of pinions meshing with it to the sun wheel. The cage rotates slowly forwards.

When the change from second to third gear is made, the centre brake is released and the foremost brake applied. This holds the input sleeve stationary so that it acts as a reaction sleeve. Power passes through the input shaft and second set of pinions, and the first set of pinions transmit reaction to the sun wheel on the input sleeve. Since the sun wheel is smaller, the cage rotates forward at a correspondingly higher speed.

To change from third to fourth speed, the brakes are disengaged and the secondary clutch is engaged. The cage then rotates at input speed, some of the power passing through the shaft and some through the sleeve, the drive being direct. Reverse is obtained with the secondary clutch engaged and the rearmost brake applied. In these circumstances, power passes through the input sleeve, through both sets of pinions, and thence to the output shaft, the cage now being held stationary.

A transmission detail of some interest is the Borg-Warner full phasing one-way clutch. It is particularly suitable for converter-coupling fluid drives, in which it is desired to mount the stator on a free-wheel. This clutch consists of a number of small cams or sprags held in circular cages by means of a ribbon spring. A unique feature is the use of two flanged cages, which ensure that the sprags are fully phased so that they work in unison and each carries its full share of the load. In shape, the cams or sprags are not unlike dumb-bells. During free-wheeling, they are automatically lifted from the races, thus eliminating wear of both sprags and races. The clutch units are compact and capable of transmitting high torque with little or no backlash. They are made in several sizes and find many other applications.

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# Brakes

*Few Changes in Drum Brake Designs, but Wider Adoption of Disc Brakes as Standard or Optional Equipment*

DEVELOPMENTS in brake design during the last twelve months can hardly be said to be of exceptional interest. This by no means implies that there is any evidence of complacency or lack of initiative among chassis or brake equipment manufacturers. In fact, considered generally, the standard of braking efficiency and safety attained by the majority of British cars represented this year at Earls Court has kept pace with the demands imposed by modern traffic conditions.

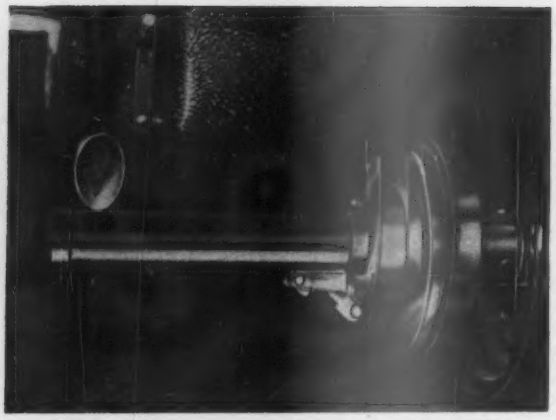
In most cases, the recent changes have been mainly confined to enlargement of the brake lining areas, chiefly by widening the shoes and drums. Contributions towards improvement have also been made by the introduction of new woven and moulded brake linings designed still further to reduce fading and to increase service life.

In view of the satisfactory results obtained with the disc brakes in their latest forms, the question might arise as to why they have not already been more widely adopted. At last year's Earls Court exhibition, it will be remembered, some examples had reached the production stage and cars were offered, in some instances, with disc brakes as standard and, in others, as optional equipment. Further progress has now been made, and not only is a greater number of vehicles at present available with disc brakes, but also a further increase seems imminent.

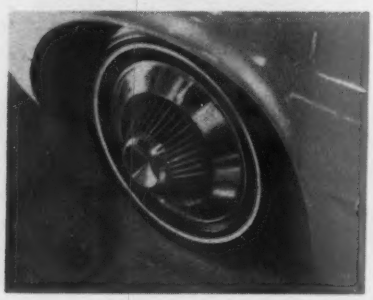
Although the practical advantages that disc type equipment affords have been well established, and its more important defects have been eliminated, the fact that its acceptance is mainly confined to high-powered racing and sports cars and a few of the larger touring types is, of course, attributable to the satisfactory performance and dependability in recent years with the drum brake. There is thus no compelling incentive to change over hurriedly to an alternative system, which at present incurs increased costs for both manufacturers and users. If the development of the disc brake with qualities as they are known today had been timed much earlier, it would doubtless have enjoyed more encouraging and more rapid recognition than it has actually received.

Hydraulic brake application is practically universally employed for cars. Where required, to reduce the pedal application pressure, vacuum power assistance is still mainly favoured for the larger and more powerful British cars, and hydraulic for those of foreign manufacture. Hydro-mechanical application is retained for the 2½ litre Daimler Century, which was not shown at Earls Court, and for the Rolls-Royce products. Mechanical operation is an exceptional variation on the Popular model in the Ford range. Of the miniature cars exhibited, only the German Zundapp Janus, with a 250 cm³ two-stroke engine has servo assistance for its hydraulic braking system.

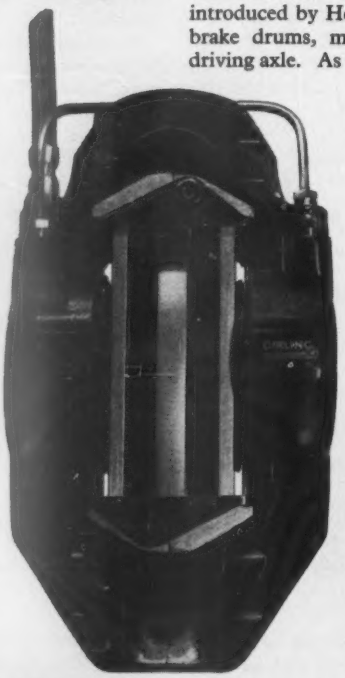
There is little to record concerning the detail design or arrangement of drum brake equipment other than the already



*Above: A single drum type brake, slightly inboard of the off-side end of the back axle, retards both rear wheels of the Meadows Frisky*

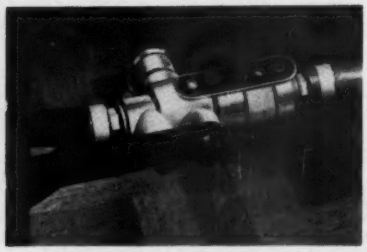


*Above: the wheel hubs of the Pontiac Club-de-Mer experimental sports car incorporate louvres to give forced-draught brake cooling*



*Left: The latest Girling disc brake has a split calliper instead of the one-piece casting previously employed. This assists production, since it simplifies machining operations*

*Below: The new Feeny and Johnson, self-releasing and self-sealing, safety break-away coupling for connecting the vacuum hoses of caravan or trailer brakes to brake systems of the tractor vehicles that are towing them*



*Below: On the Heinkel car, the twin rear wheels are retarded by a single, cable-operated, drum brake operating only on the near-side wheel*

mentioned trend towards increased lining area. Examples of this are the new Vauxhalls, the total brake lining area of which has been increased, by 37 per cent as compared with the previous models, to 138 in². This has been effected not by increasing the drum diameter, but by widening the shoes and linings to 1¾ in at the rear and 2¼ in at the front. Although the tendency of the drums to *bell mouth*, owing to the rigid connection between the brake track and the hub, would normally be increased by such widening, this tendency has been offset by attaching the centrifugally cast, iron track to the hub by means of a cast-in, pressed steel flange, about ⅛ in thick, with a serrated edge: this pressing is said to expand at the same rate as the brake track casting. The serrations key the flange securely to the brake track in the casting process.

Two examples of a single brake assembly being used to retard both rear wheels were seen on vehicles exhibited at the Show for the first time. The new Frisky sports car, introduced by Henry Meadows Ltd., has two 7 in diameter brake drums, mounted about 4 in inboard on a tubular driving axle. As the rear wheel track is only 32 in, a differential is not fitted and the final drive is taken from the single-chain, through a one-piece axle to the two wheels.

As originally designed, both brake drums contained Lockheed shoes applied hydraulically by the pedal and mechanically by the hand lever and cable. M.I.R.A. tests, however, showed that this resulted in too severe braking of the rear wheels. The shoes in the near-side drum, therefore, have been omitted, although the drum is retained. With linings 1¼ in wide, the total lining area is 58 in², and braking distribution of 60 per cent on the front wheels and 40 per cent on the rear is obtained. The combined hydraulic master cylinder and reservoir unit is mounted on the tubular chassis frame immediately behind the brake pedal.

A similar arrangement is adopted for the twin rear wheels of the four-wheel version of the German Heinkel miniature car. Like those of the Frisky, the rear wheels are fitted with 440-10 tyres and are driven by a single chain through a very short shaft, the track being only 8½ in. A cable control mechanically applies the brake in a drum mounted on the near-side wheel. Hydraulic brakes are fitted to the two front-wheels, and the total lining area is 58 in².

That the disc brakes exhibited last year have justified expectations by their performance, particularly on racing

and sports cars, is indicated by the almost complete absence of modifications. The principal change evident in the latest designs, by both Girling and Lockheed, is the use of a centrally-split calliper in place of a one-piece casting previously employed. The halves are held together at each end by one or two bolts, according to the size of the brake. This innovation assists production, since it simplifies the machining operations: each half is bored, faced, drilled and tapped separately. The new callipers are also more compact, and there is some reduction in weight, which is important, of course, because of the fact that it is unsprung weight.

Undivided calliper castings are retained for the Dunlop disc brakes, the demand for which has justified the special plant laid down for their production. The complete machining of each calliper is carried out in 22 separate operations by one machine. Working at about half-capacity, the output is 90 per hour. Dunlop disc brakes are standard equipment for the front and rear wheels of the new Bristol 406 export model, the new R series 541 Jensen and the Jaguar XK150, and are optional on the Jaguar 2·4 litre and 3·4 litre models.

The latest Lockheed Type M disc brake, suitable for cars with laden weights of about 3,100 lb, and the Type H, for heavier vehicles, have split callipers of more uniform contour than those previously produced. Advantage is taken of the central division to provide an internal balance duct between the two hydraulic cylinders. This duct is formed by drilled connecting passages in the two castings, thus eliminating the outside pipe which is liable to be damaged by flying stones.

The new version of the Girling disc brake, apart from the fact that it is of the divided type, is similar to its predecessor. A working model on the manufacturers' stand demonstrated the ease with which the segmental friction pads can be extracted for renewal through the central aperture of the calliper, merely by loosening two retaining plates. The adoption of this brake by car manufacturers has further extended. It is standard equipment for the front wheels of the Triumph T.R.3, the new Aston Martin DBIII, and the Fairthorpe Electron, and is optional for all wheels of the Lotus Eleven Le Mans and Elite cars, and for the front wheels of the A.C. Ace and Aceca.

Two new mechanically-actuated hand brake arrangements are now offered by the Lockheed Hydraulic Brake Co. Ltd. One is a Bowden cable-actuated unit operating on the discs to which the hydraulic wheel brakes are applied. The other is a drum type, transmission brake on the rear end of the propeller shaft. This transmission brake has a 7 in diameter drum. Its two 2¼ in wide shoes are actuated by a cam lever at the top, and at their base there is a floating abutment incorporating an adjuster.

A noteworthy feature of the disc brake, which is mounted on the calliper of the hydraulic wheel brake, is its self-servo action, which gives additional braking effect with normal application effort. Circular friction pads, bonded to steel carrier plates, are applied to both sides of the disc by a pair of channel section actuating levers pivoted on brackets secured to each side of the hydraulic calliper. The outer ends of these levers are connected by a spring-loaded bolt, which conveys the reaction that equalizes the application pressures of the pads and which also is used for adjustment of the pad clearances.

A control lever is pivoted on the inboard of the two actuating levers. Pinned to one end of this control lever is the adjustable end of the control cable and, to the other end, a pair of thrust links. These links pass through an aperture in the back of the adjacent actuating lever, and are connected to the friction pad carrier plate. When the cable is pulled, the control lever is moved and the thrust links apply the pad to the disc; at the same time, the reaction through the actuating lever assembly causes the pad on the other side also to be applied with equal force.

The servo effect is produced by the addition of a triangular-shaped steel cam plate carried, between the thrust links, on a vertical pin. This pin is passed through slots in the links; washers fitted in grooves in its ends hold it loosely in clearance holes in the upper and lower flanges of the actuating lever. The base of the cam plate is normally parallel to and just clear of the pad carrier. Its ends are rounded to a small radius, and between them the plate is recessed to curve closely round a projection in the centre of the friction pad carrier.

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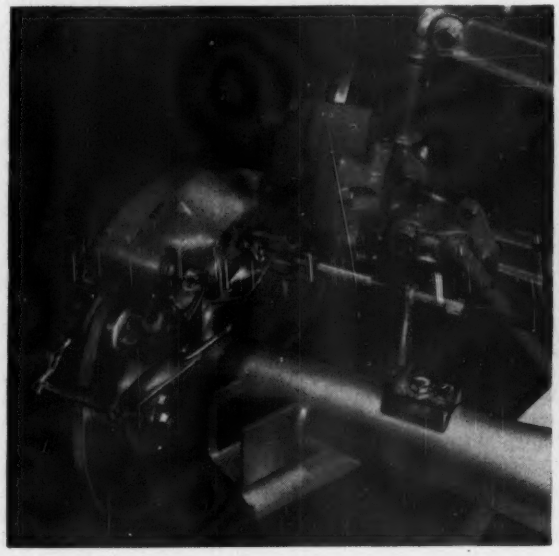

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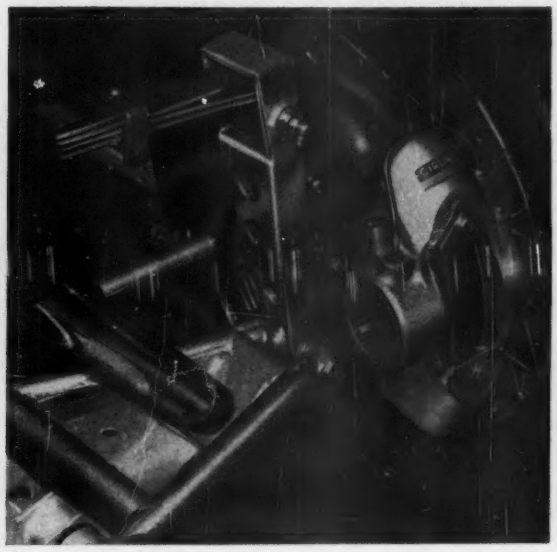

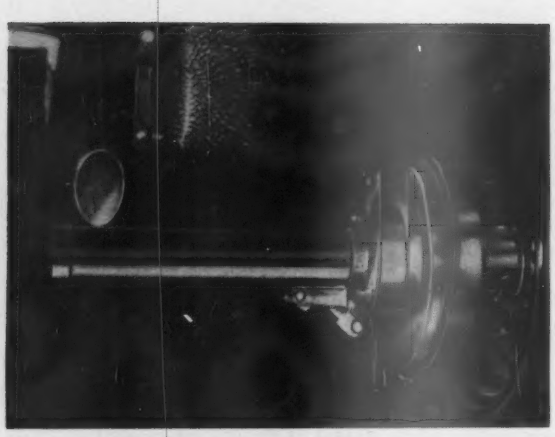

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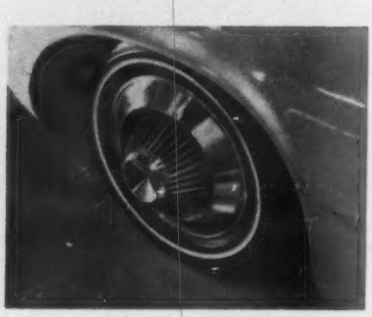

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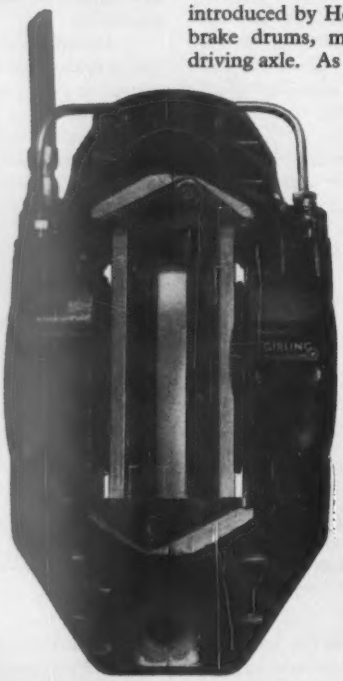

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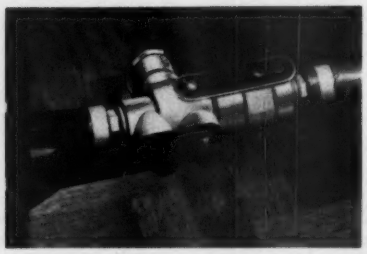

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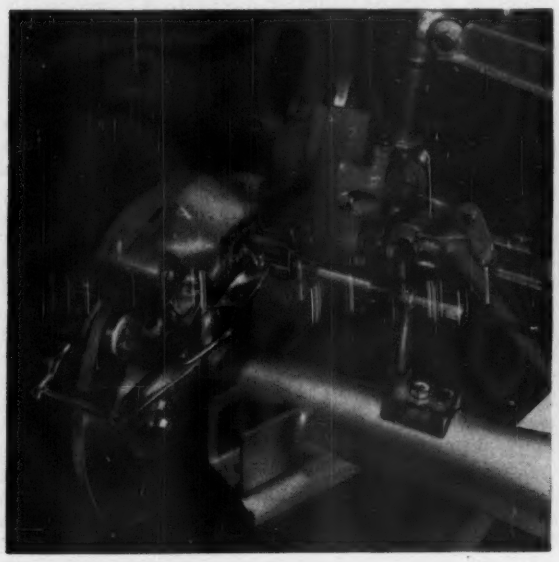

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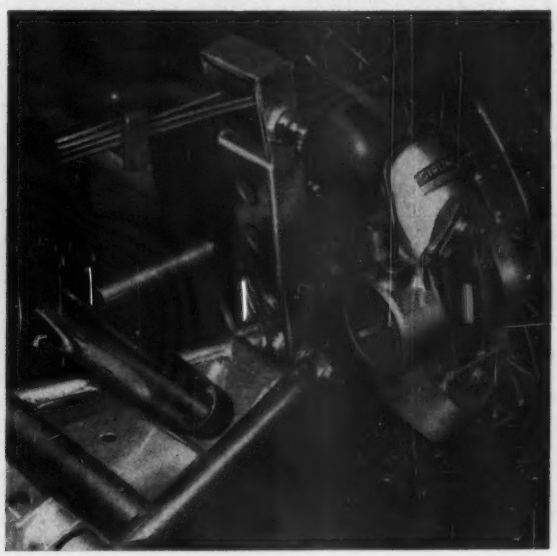
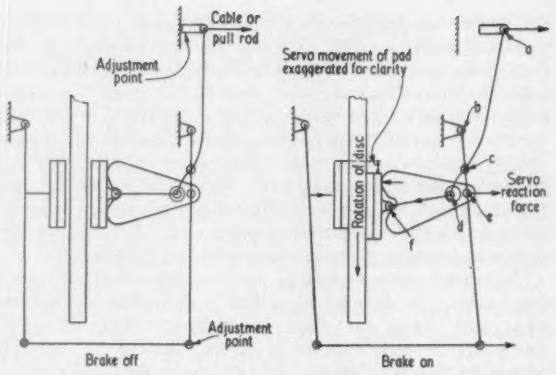


wedging action and its reaction, exert additional application pressure on both sides of the disc.

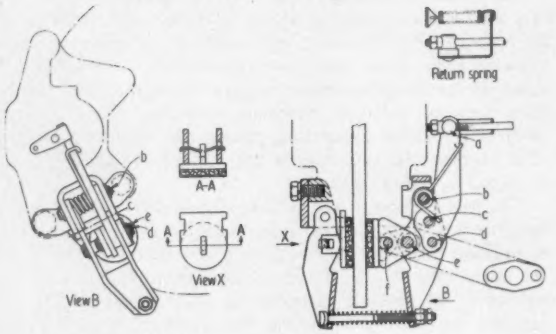
Lockheed have also produced new vacuum braking equipment for caravans and trailers. This comprises a diaphragm control valve, which can be operated either hydraulically or by a Bowden cable, a vacuum reservoir, a servo unit, and a trailer brake hose coupling with a sealing valve, held open when the hose is coupled and closed when it is disconnected. The servo operates a pivoted lever, from which a rod connection is made to the cross shaft of the brake system. The point at which the lever is drilled for attachment of the rod can be selected to obtain the leverage best suited to requirements.

Feeny and Johnson Ltd. have produced a new safety, breakaway hose coupling for caravans and trailers using the same vacuum braking system as that installed on the tractive vehicle. This is basically the same as the maker's earlier model. The body of the unit contains a spring-loaded sealing valve. This valve is held open by the male portion of the coupling on the trailer hose when it is inserted, and closes when it is detached. The end of the male portion is grooved, and is held by steel balls housed in the main body. These balls are locked in the groove by moving a sliding sleeve rearwards. To detach the hose, the sleeve is moved forwards.

In the event of a breakaway of the trailer, severing the hose, the male member would be undisturbed and would hold open the sealing valve so that the vacuum in the tractive braking system would be lost. This is prevented in the latest design by a simple modification. The sliding sleeve, instead of the main body of the coupling, is held in the mounting bracket on the tractive vehicle. Thus, if the trailer breaks away, exerting a pull on the hose, the main body is pulled back and the sleeve is moved forwards relative to it, releasing the male member with the hose intact, so that the sealing valve closes and there is no loss of air.




*Above and below are diagrams illustrating respectively the principle of operation and layout of the Lockheed, Bowden-cable-actuated hand brake, operating on the discs to which the hydraulic brakes are applied. The key letters a, b, c, d, e and f are used to identify the pivots in one illustration relative to those in the other, for ease of comparison*




# Electrical Equipment

## *Detail Improvements and Some New Applications*

IN design and construction, electrical equipment remains much the same as it was in 1956. Such changes as have been made are largely in minor detail, making for simplification, easier and wider application and, where external appearance is of importance, embellishment. As in 1956, the trend towards an increasing number of electrically-operated accessories and components continues. Supplementary driving lamps, windscreen wiper and washer, radio and heater find place on all but the lowest priced cars; semi-automatic transmission has been adopted on more, and offered for many, small and medium sized cars; overdrives are either standard, or are available for almost any type of car in the higher price brackets; and there are some notable additions by way of hood, seat and window operating gear.

In line with this trend there has, of course, been a marked increase in the use of a higher capacity dynamo, and of the current-voltage system of dynamo regulation. Moreover, there has been a marked improvement in instrumentation. Of direction indicators, the flashing type has now become universally adopted for new cars.

Of items completely new in conception or application, there were four British and two foreign. The new British developments were a K-L combined main or dip beam flashing and accessory switch for facia or steering column mounting; a Simms transistor regulator; and two Smiths items, of which one was a semi-conductor type transmitter for a temperature indicator, and the other a complete system of air conditioning, designed to provide temperature comfort in any part of the world. The two new foreign products were the Bowmonk-Dowidat overtaking signaller, marketed in this country by Bowser, Monks and Whitehouse Ltd., and a Scintilla alternating current generating set complete with rectifier and control box.

Among the American cars, of course, there were some novel front and rear lighting arrangements, the most notable of which were to be seen on the Edsel and an experimental Pontiac called the Club-de-Mer. Also notable among American cars was the Ford Skyliner, which, it is claimed, has the world's first automatic, power-operated, fully retractable hardtop. This equipment, operated by the touch of a button and powered by seven electric motors functioning in sequence through the medium of hydraulic and rotary cable gear, converts the car from a saloon to an open tourer in less than a minute.

Considered as a whole, the Show proved that the design, construction and layout of British electrical equipment are second to none. Moreover, it was particularly gratifying to find that in conformity with Continental practice, the

Aston Martin DBIII is equipped for headlamp flashing without recourse to removing a hand from the wheel; that the Lucas petrol injection system, which was introduced shortly after last year's Show and described in the January 1957 issue of *Automobile Engineer*, was on view; and that the Smiths Selectroshift transmission system, described in these columns last year, is offered as an optional extra on a number of small French cars.

**Generators, starters and control boxes**

All the well known ranges of dynamo, starter and control box were exhibited. By all accounts they continue to arouse lively interest. The greatest interest, however, was shown in the pointers to the future, as exemplified by the Scintilla alternator set, the Simms transistor regulator and the application of the Siba Dynastart to certain types of miniature car, such as the new British Frisky.

At present, Scintilla alternators are available in three sizes; namely Type DD 01/2, Type DD 2/2 and Type DD 3/2. Type DD 01/2 is obtainable as a 6V, 12V or 24V unit, its nominal output, as measured on the direct current side of the rectifier, being 60A (360W), 35A (420W) and 19A (456W) respectively. The remaining types are obtainable as 12V or 24V units, Type DD 2/2 having a nominal output or 67A (804W) or 36A (864W) accordingly, and Type DD 3/2, consisting of one 12V and two 24V units, have outputs of 130A (1,560W), 65A (1,560W) or 130A (3,120W). All types are ventilated, three-phase machines with star connection phase windings in the stator and a single field winding on the rotor. The phase windings are brought out to those terminals marked X, Y and Z, and the field winding to a pair of slip rings, which, through the medium of spring-loaded brushes, are in circuit with a pair of terminals marked 17 and 18. Rotor design is such that there are eight poles.

Companion equipment for the alternator consists of a metal rectifier and control box. To facilitate application of the system, and because of the sensitiveness of a metal rectifier to temperature rise, two styles of rectifier are available for each type of alternator. One is comparatively small and applicable where forced air cooling can be resorted to; the other is comparatively large and applicable where ample space is available and self-cooling can be relied upon. Only rectified current passes through the control box, and the rotor field coil, is fed therefrom either directly by the alternator or by the battery according to circumstances, that is, above or below charging speed. To prevent battery discharge through the field coil when the engine is at rest, the field coil is wired in circuit with the ignition switch, or, in the case of a diesel, with the heater plug switch or the master accessories' switch.

The control box incorporates three units. They are a relay, a voltage regulator and a current regulator. The core of the relay carries a voltage coil, and on a movable carrier there are two main and two auxiliary contacts. The core of the voltage regulator carries a voltage and a demagnetizing coil. For voltage regulation, four contact sets are used. The current regulator, except for a heavy gauge current coil, is of the same construction as the voltage regulator in that it has four contact sets.

In view of the trend towards an ever-increasing number of lamps and electrically-operated accessories, alternating current generators, such as the Scintilla, with its high output and relatively small dimensions, hold promise of extensive use. Moreover, they have many other advantages, in that they are devoid of a commutator and have instead a pair of fully-enclosed slip rings. They are simple to manufacture and service; are impervious to moisture and dirt; require little, if any, radio suppression and have an extremely long service life. Being separately excited during build-up, they commence to charge the battery at very low alternator speed, thereby maintaining the battery at a fair state of charge under the worst traffic or operating conditions.

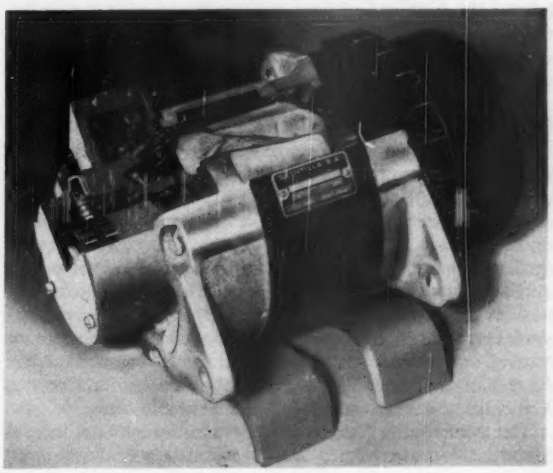
Electronic regulation of low voltage generators for cars and commercial vehicles is no longer a dream of the future if the new transistor regulator, announced by Simms Motor Units Ltd. in July and exhibited for the first time at the Show, fulfils all the claims made for it. Considerable development work has been completed, and has resulted in the production of a small, compact unit having no vibrating contacts. It is reliable, easy to adjust and capable of very close control under all conditions. Further, it cannot cause radio or television interference. Experimental units have been undergoing tests with particularly encouraging results, but supplies will not be available for general use for some little time, when it is hoped to produce models suitable for all types of motor vehicle.

In the circuit undergoing tests, control is maintained over voltage and current so as to give the same effective results as the present Simms system. A grounded emitter circuit is used with silicon voltage and germanium current reference diodes. Blocking is effected by means of a germanium diode, which, together with an assurance light connected in circuit, provides a non-linear resistance in operation.

At the other end of the scale, the advent of new makes of miniature car has led to increasing popularity of the starter-generator, as for example, the Bosch model on the Zundapp Janus and the Siba unit on the Frisky. Both these models follow the same design, having a 12-pole field assembly, complete with brush gear located within a bell-type armature. The field assembly is secured directly to the engine crankcase and the armature directly to the crankshaft. The hub of the armature extends inwards to leave an annular surface whereon a disc type commutator is accommodated. The two brushes are set at 180 deg, and are located by box holders and tensioned by compression springs. They make endwise instead of the usual radial contact with the commutator. Attached to the outer end of the armature is the ignition contact breaker cam carrier-plate. The entire assembly is very short and compact, and fully enclosed.

However, the most interesting aspect of the Siba Dynastart is its application to cars which, like the Frisky, have a two-stroke engine and no reverse gear. Taking advantage of the characteristic of such an engine to run effectively in either direction of rotation, Siba Electric Ltd. have provided facilities whereby, at the will of the driver, the Dynastart can be made instantly to operate in either direction for forward or reverse starting, and consequently, for forward or reverse vehicle motion. These facilities consist of a special ignition

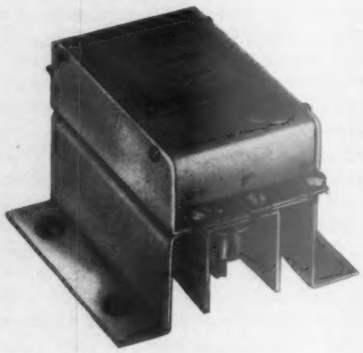
*The new Scintilla three-phase alternator*



key starter switch, two appropriately set contact breaker rocker arms—one of which is for forward and the other for reverse operation—with two differently coloured warning lights for indicating forward and reverse operation respectively, and a solenoid-operated dynamo-starter reversing switch. The ignition key starter switch combines the ignition switch and starting reversing solenoid contacts. Pressing the switch before turning operates the reversing solenoid, and additional rotation after the switch has been turned on operates the starting solenoid. A further refinement allows accessories, such as radio, to be used when the ignition is switched off and the key removed.

For the control of the Dynastart as a dynamo, a cut-out and a voltage regulator are provided. These are incorporated in a small control box, to the cover of which the ignition condenser is secured. The control box, together with the starting and reversing solenoid switches, the ignition coil or coils, and a terminal board, are neatly grouped on an enclosed panel to form a single unit called the switchgear box. To ensure correct reconnection during servicing operations, all terminals differ in size and all cables in colour.

In passing, it is worthy of note that Bosch dynamo-starters of comparable design to the Siba unit are available with either



*The Simms transistor regulator*

a bell or a drum armature. Also noteworthy is a new alternator, called the Series 100, which has been added to the well known Wico-Pacy range of flywheel ignition type generators for caravan or motor boat lighting and battery charging.

Generally access to electrical units was somewhat restricted on Continental cars, particularly on the miniature vehicles. Two notable exceptions in this respect were the Borgward and the Heinkel, but even on these easy access can be made only to the battery and control box. For ready accessibility to all electrical units, British cars are supreme, all engine-mounted units usually being on one side, and all others on or near the bulkhead, as exemplified by the Morris Cowley.

### Batteries and lamps

All the well known ranges of batteries were exhibited, as also were a new range of Extra Life by Siemens Edison Swan Ltd., and some specially developed Buckland and Exide units for three-wheelers and other lightweight cars. These Buckland units are called Mini-Bats. They are extremely small, compact and light, fitted with dry-charged plates and micro-porous plates, and require only an overnight charge to be ready for immediate use. Six terminal layouts are available, namely left- or right-hand location, knurled screw, small Continental or standard taper post, and drilled lug. Mini-Bats are standard equipment on Astra, Atom, Coronet, Frisky and Heinkel cars.

The comparable Exide units are additions to the famous Silver Exide range. They are three in number, all 6V units. Two of them, Type 3-EV11 and Type 3-EY7, are assembled in containers of translucent, high-impact polystyrene. Two red lines are marked in the sides, indicating maximum and minimum electrolyte levels, which can be checked at a glance without removing the filler plugs. The cell covers are in black polystyrene, permanently cemented to the containers.

In the Type 3-EY7, double separation is used between the plates. It consists of sheets of Porvic micro-porous plastics and glass wool. This combination not only provides complete immunity against internal short circuits, but the wool also acts as a mechanical retainer for the active material without impeding the free diffusion of the electrolyte.

The Type 3-EV11 has single separation consisting of Porvic. In both types, the intercell connections are made internally through cell partitions by means of acid-tight joints to reduce the length of the current path and minimize voltage drop. Particular attention has been given to ventilation. Each cell vents into a common chamber, from which gas escapes through holes in two of the filling sockets. The filling holes are large enough to permit easy topping-up and the acceptance of the Exide topping-up spout, which is a great advantage where batteries are housed in relatively inaccessible positions. Moreover, the flush-fitting ebonite filling plugs are fitted with coin slots to facilitate unscrewing. Coin slots are also provided in the cadmium plated terminal screws.

Of these three Silver Exide batteries, the largest is Type 3-EY7. It has been adopted as initial equipment on the 1957 Bond Minicar, being fitted in duplicate for starting and lighting duties. It is, incidentally, also being specified for radio-equipped motor cycles for police forces.

Another new, specially designed Silver Exide battery for miniature and lightweight sports cars is the 12V, Type 6-VNF5/7L. It has been adopted as standard equipment by Berkeley Coachwork (Sales and Export) Ltd. for the Berkeley sports car and also by Lotus Engineering Co. Ltd. for their sports racing cars. Its capacity is 23 Ah, and its weight, filled and charged, is only 26 lb. Each cell is made up of five special plates with CB.95 antimonial lead alloy grids and Porvic separators. The plate groups are assembled in a hard rubber container that has the resilience needed to withstand the severe vibration experienced in high-speed competition motoring. Overall size is an important factor on small cars, particularly on the Lotus, where the battery is mounted at the extreme rear end of the chassis and space is restricted. The 6-VNF5/7L is only $9\frac{1}{4}$ in long, $5\frac{3}{8}$ in wide and $7\frac{7}{8}$ in high. It has the usual Silver Exide flush type intercell connectors.

A Lucas battery for lightweight cars is the 12V model HO7A/8. It is a design with special flat-tongue terminal posts, with bolts and nuts for holding the cables in position. This battery is fitted as standard to the Isetta, and is readily available as a replacement. Its dimensions are $9\frac{1}{2}$ in long, $5\frac{7}{8}$ in wide and $7\frac{1}{4}$ in high, its capacity is 30 Ah at a 20-hour rate, and its polarity is A-8. Glass wool is used for the separators.

With regard to lamps, the most outstanding developments were shown to be on fog, long-range and pass lamps, as exemplified by Bosch, Butlers and Lucas products. The new Bosch fog and long-distance lamps, Types LE/NEB130 and LE/WEB130, are of shallow design for easy accommodation in the very restricted space between the radiator or wings and the bumper of modern cars. They are of clean, contemporary styling, and are commonly referred to as *slim lamps*. The bracket fixings are readily adjustable and are available in two types for horizontal or vertical fitments respectively. Rubber bushes, to ensure safe and lasting fixing are also available. It is claimed that the reflector of these lamps throws as much light from a 35W bulb as an ordinary reflector does from a more powerful bulb. If

desired, the fog lamp is obtainable with a yellow lens. Both lamps are 130 mm (5 $\frac{3}{32}$ in) diameter and 70 mm (2$\frac{3}{4}$ in) deep.

Still slimmer are the new Butlers Discus fog and pass lamps, Types 1539/B and 1539/A. They are 7 in diameter and 2 $\frac{9}{16}$ in deep. By means of a novel combination of reflector, bulb and lens, a beam of optimum distribution has been obtained. The beam has the flat top cut-off so highly desirable in auxiliary lamps of this class, obviating back-glare irritation to the user and dazzle to an approaching driver.

The reflector of these lamps is of unusual design, consisting of a stepped series of parabolic sections of different focal lengths, but all having a common focal point. This arrangement permits a much shallower form to be used than with a conventional single parabola. In order to obtain the most desirable and the finest possible reflecting surface, the reflector is produced from specially selected mirror-finished steel and treated with an aluminizing process.

The bulb also, is unusual. It is of tubular form with festoon-type end contacts that are so proportioned as to ensure the minimum obscuration of the reflector for the utilization of the maximum light flux from the filament. Bulb location is such that the filament is held in a predetermined focal position, thereby eliminating the necessity of any focusing adjustment. Much laboratory research and practical night driving tests were carried out before the final form of bulb was arrived at, and it is now offered in quantity production with every confidence.

The Discus is of extremely good workmanship throughout; the shell is produced from specially finished brass, the bracket is of heavy gauge brass, and the whole is finished in highly polished chromium plate. Adequate adjustment to suit individual requirements is provided at the mounting bracket. A suitable length of cable and a control switch of good quality and attractive appearance are also provided. The fog lamp has a yellow lens.

A new development in the Butlers range is a shallow reversing lamp with an illuminated tell-tale switch. It is called the Disc-ette and is 4 in diameter and 2$\frac{1}{8}$ in deep. It is bracketed so that the distance between the front of the lens and the centre of the bracket is 1 $\frac{15}{16}$ in. A standard SBC, single-pole, single-filament bulb of 6W or 18W is fitted as required, with a multi-parabolic reflector of the type employed in the Discus, and a spreader type lens. The combination of the multi-parabolic reflector and the spreader type lens makes the area of illumination exceptional and, although the wattage is modest, adequate over the whole cone of light. The Disc-ette may be mounted in the upright or pendant position, being equally waterproof either way.

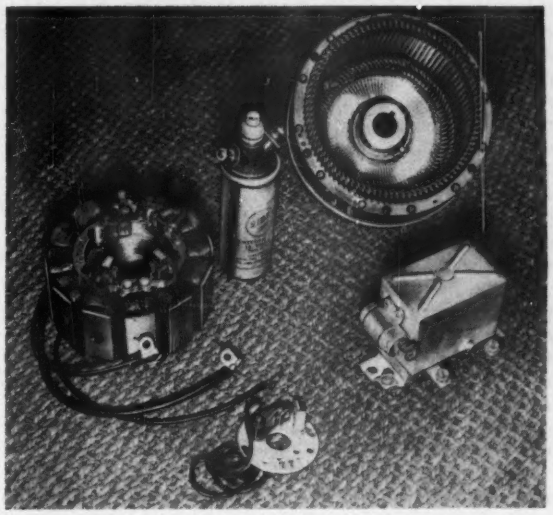
In addition to the famous SFT576 and SLR576 range, which have the more normal spigot-fixing, Lucas fog and long-range lamps suitable for back fixing are now available. The clean distinctive lines of the original versions have been retained. These new lamps have become increasingly important in view of the number of modern cars having a limited frontal area. They are easily fitted by drilling a single hole in the required position. Their bulbs are 48W units.

Other notable contributions to matched pairs of driving lamps were made by Ceag Ltd., Marchal Distributors Ltd., and Notek Electric Co. Ltd. They consisted of the Ceag Lumax F7 fog lamp, with a yellow anti-glare bulb; the Marchal Visorim fog and driving lamps, models 680 and 682, which are styled to blend with the forward look of the headlamps of modern cars, and equipped with a peaked visor for sheltering the glass from road filth, rain and falling snow; and a Notek micromatic and spring-loaded fitting, whereby their Farlite and Nearlite lamps can be instantly adjusted and thereafter be made to return automatically to their aligned position in the event of their being accidentally pushed over. A Lumax sport lamp with one-nut adjustment was also exhibited.

In the realm of headlamps, Marchal featured two new versions of their Optiques. These are the 6969 de luxe and the 6063 standard, both of which can be used to replace the standard 7 in light unit fitted to all current British and American cars. In conformity with the new European Lighting Code, they are of the asymmetric variety, each light unit giving a vertically split beam when dipped, the off-side half of which functions as the normal dazzle-free, horizontal cut-off, while the near-side half is uplifted 15 deg to illuminate kerbside obstacles, such as cyclists or pedestrians. Moreover, in having a three-prong bulb connector they permit, when driving abroad, the necessary change-over for driving on the right to be easily effected by merely turning the bulb from one marked position to the other.

The advent of the new Unified European meeting beam system is an attempt to bring the standard of meeting beam performance on the Continent up to that of the British and American systems. This means that the asymmetric principle is new to Continental vehicles and they are now about to follow what has been standard practice in this country for some time.

It is, therefore, of further interest to note that Joseph Lucas



*Standard Siba components. Top left: Dynastart field and brush gear. Top centre: ignition coil. Top right: Dynastart armature and commutator. Bottom left: contact breaker. Bottom right: control box with externally-mounted condenser*

Ltd. have produced a light unit suitable to meet the Unified European requirements for use on the Continent. The design of this unit has, of necessity, been made to conform with the new European standard, a necessity that has led to the development of a new focal length reflector, although the diameter of the unit remains at 7 in. One of the features of the new bulb is that a three-prong connector, of the type used for American sealed beam units, has been adopted as standard, but in all other respects, the unit and bulb will replace the present Lucas 700 Continental, Le Mans and P700C units. The new Lucas light unit more than meets the new legal requirements.

Two other British developments relating to headlamps were the K-L multi-beam signal control and flasher and the Wingard headlamp visors. The former is a well constructed, extended-lever switch, which only serves to flash the main or dip beams as an overtaking or road-crossing signal in conformity with the Continental practice, and in addition can be used conveniently for other accessory switching. It can be applied readily to any car, being designed for facia or steering column mounting, and has four positions

*New Lucas lamps. Left: long range. Centre: fog lamp. Right: parking lamp for roof or window mounting*

of contact. Of these, two are free, in that the lever remains on until manually cancelled. The other two positions are fixed, being those in which the spring-loaded lever automatically cancels itself when finger pressure is withdrawn. Because there are four contact positions, a considerable number of switching combinations is made available. The free positions are for flashing dipped or main beam lights when driving on side lights, or for flashing main beam lights when driving on dipped beams; and the fixed positions for the control of such accessories as demister, fog lamps, windscreen washer, parking lights, or special-purpose warning lights. Where the device is to be used for one purpose, a relay is unnecessary, one or more relays being required only when multi-purpose usage is adopted. Special relays for multi-purpose operation are available, one of which dispenses with the need for a foot-operated dip switch.

The Wingard headlamp visors are beautifully finished in deep chrome and are of highly stylized design to enhance the appearance and improve the lighting performance of cars. They are easy to fit, and a rattle-proof rubber rim is supplied.

For ancillary lighting there were three new products of particular interest. Lucas exhibited a new parking lamp, model L610, which can be mounted on the roof or a suitable window. The body of this lamp is moulded in grey plastics and the two lenses, white and red, are moulded in Diakon. A hard rubber bracket, provided for window-mounting, is discarded when roof-mounting is required. Special arrangements make the lamp very easy to wire up.

Next came the Flickon under-bonnet light by James Neale and Sons Ltd., and third, the Wingard interior pillar-fitting lamp. This lamp, comprising a suede-grey, plastics base with a white plastics lens incorporating a clear opal bull's eye for light intensification, is of rectangular construction, measuring $4\frac{1}{2}$ in $\times 2$ in $\times 1\frac{1}{2}$ in. There are two models, the 406 and 407 for left- and right-hand mounting respectively.

There can be little doubt that insofar as the application of lamps is involved, most British cars of this year's Show were neat to the point of elegance. Even on cars in the lower price brackets, this proved true. The Ford Anglia and Prefect models have new rear lighting, which is particularly attractive, efficient, weatherproof and easy to service. The respective twin lamps and reflectors are accommodated in flush-fitting housings, containing independent rubber seals and detachable white plastics diffusers behind the respective amber and red plastics covers. Another particularly good example of elegant lighting on a low-priced British car was that on the Standard Pennant.

Continental lighting remains almost unchanged, the only real departure being that seen on the Borgward, where the headlamps are equipped with exceptionally big visors, and the side lamps, which also incorporate direction indicator bulbs, take the form of streamlined flares rising from the wings. The number plate illumination lamp is backed with Perspex, so as to provide lighting for the boot interior.

For simplicity and sheer utility of lighting in the Continental miniature cars, the Heinkel was a good example. This car has just two headlamps, serving also as side lamps, with their rims standing proud of the wings, and proud tail lamps either side of the number plate with a proud lamp above. All three rear lamps, although not flush-fitted, are full-back-mounted in a manner making for an extremely neat and effective assembly. Flush-fitting rear lamps were, incidentally, to be seen on the Zundapp Janus, another German miniature car. They are similar to those of the Ford Anglia, but with external rubber sealings and without independent reflector sections. Below them, close to the bumper, are round built-in reversing lights, and number plate illumination is by two back-fitting proud lamps, one each end, containing a festoon bulb.

Among the American cars of note was the Cadillac with very extended but elegant headlamp visors formed in the wing sections, and, below the bumper, wrap-round side and direction indicator lamps and matched pairs of fog and pass lamps. The Chrysler has extended wing-visored dual headlamps and, according to the model, the side and direction indicator lamps are above or below the bumper. On the Edsel, which has very modestly wing-visored dual headlamps, wrap-round-corner-grille side and direction indicator lamps are fitted. At the rear, lengthy, transversely-disposed parking, tail, stop and direction indicator lamp housing assemblies are vertically divided by the boot lid. Separate, rectangular reversing lamps are mounted above the bumper.

The experimental Pontiac Club-de-Mer has powered rotary front-end lamp mountings, by means of which the lamps are moved in to or out of the position of use. In the out-of-use position, the lamps are fully enclosed, while the exterior of the mountings form a flush, streamlined surface with the cowl. The lights are switched on automatically as the lamps are pivoted into the in-use position, when only the fronts of the lamps are exposed.

**Windscreen wipers and washers**

In this field, A.C. Delco have developed a remote-control switch for the powerful two-speed wiper introduced in 1956. It is designed for facia-mounting. A modified form of the well known Bosch wiper was exhibited. Bosch have also introduced a washer, but details are not yet available.

Lucas have designed a new, powerful wiper motor, Model FW2, suitable for direct mounting on, or adjacent to, the windscreen. Primarily, it is intended for fitment to sports cars with folding windscreens. Otherwise, it is particularly applicable where windscreen-mounting is desirable and, of course, where a replacement is required for use on older cars. The extra power is most advantageous for use on fast cars and, of course, on the curved windscreens of modern vehicles. Provision is made for hand wiping and for manual parking. This model is supplied with two-hole fixing and is complete with arm and blade. The Lucas Screenjet washer is standard equipment on many cars, wired in some cases for independent operation, and in others for combined operation with the wiper.

Trico-Folberth featured their latest development in windscreen washer co-ordination. This system allows

wipers and washers to be operated jointly by one control button. When the spray stops, the wipers continue to function until the screen is clean and dry, and then park automatically. The wipers can, of course, be operated independently of the washer co-ordinator if desired. An important feature of the co-ordinator is that when the water jar is empty, the system will not operate, thus preventing the blades from running dry over a dirty screen and causing a smear in the area of vision. Co-ordinator sets are available for single or twin electric or vacuum wipers.

**Direction indicators and horns**

Other than the American and Continental applications previously referred to under the heading "Batteries and lamps," there were no departures in regard to direction indicators. All the well known ranges were exhibited, including some semaphore types, which, of course, are available for replacement on older cars. Horns, too, remain, for the great part, unchanged.

**Ignition and accessories**

There were five new ignition products. Two were Delco-Remy units, consisting of a starter-ignition switch and a distributor. As many as five positions have been incorporated into models of the former, and variations include separate accessory switching and the predetermined use of the starter switch without the key, so as to employ only one key for ignition, doors, boot and glove box, while permitting the operation of accessories, such as the heater or radio when the engine is idle or when the car is left in a runable condition in a public garage without fear of pilferage therefrom. It is indeed a most ingenious switch and already has found place on a number of new cars, among which are the Vauxhall Cresta and Victor.

The new Delco-Remy distributor is classified as the D200 Series. It sets a new high standard in construction and ignition accuracy. It is largely of all-steel construction and has a large internal oil reservoir, which ensures continuous lubrication of particularly long sintered iron sleeve bearings. Service of the unit is carried out on a 5,000 mile basis. It is now standard equipment on Vauxhall and Bedford vehicles.

New in the K.L.G. range of spark plugs are two types with overhead earth electrodes. They are type named the F and FE100, with $\frac{1}{2}$ in and $\frac{3}{4}$ in reach respectively. This particular type number is already well known in the K.L.G. 14 mm range, and the new plugs will augment the existing F and FE100 disc or side fire plugs.

The idea behind these new plugs is to provide fully efficient operation throughout the speed range of a high-performance engine, from crawl to maximum speed. To accomplish this, in addition to an overhead earth electrode, these plugs have a large gas hole, to ensure maximum flame access in and around the mouth of the plug, and a slim, short insulator nose, which aids burning-off of any deposits during slow running and the rapid dissipation of heat while running at high speeds. Further, the high aluminium content of the insulator, which has remarkable thermal and mechanical properties, enables it now to be made in much thinner form to give a greater performance range.

There were two new Lucas coils, the Model SAR sports coil and the Model LA in two types, 6V and 12V, for general use. The windings of the SA12 are enclosed in a container larger than normal in order to give greater heat dissipation. The moulded top has been ribbed to prevent tracking and, as an additional safeguard, it is coated with an anti-tracking varnish. Its performance is such that the plug gaps can be increased so as to ensure easier starting and increased performance. Although the coil is for sports use, it can, of course, be applied with beneficial results to any coil ignition vehicle. The Model LA coil also embodies a new cooling process which, together with other features, results in a performance of a very high order. It is also worthy of note that the Champion Sparking Plug Co. Ltd. have adopted a new system of numbering of spark plug type, according to the heat range principle.

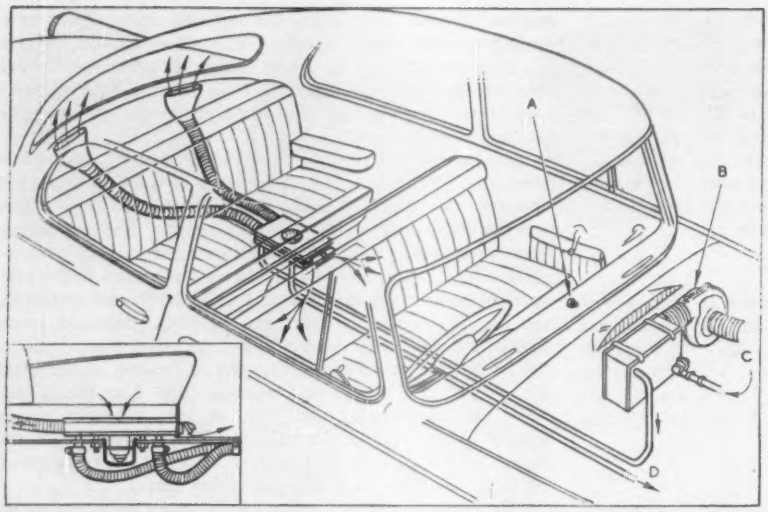
Three new items among the accessories were of particular interest. They were the Bowmonk-Dowidat overtaking signaller, the Lucas Model 56SA combined switch and warning lamp and the Wipac facia switch. The overtaking signaller employs two prime units; a receiver and a transmitter. The receiver is an audiometer for fitment to the rear of the vehicle. It is impervious to dirt, heat, and vibration, and can be adjusted to pick up the sound from an overtaking vehicle. The transmitter incorporates a vibrator, transistor and transformer, whereby the signal is amplified and passed to a buzzer and warning light near the driver, while an acknowledgement light to the following driver appears at the rear of the vehicle. The adjustment of the audiometer is such as to permit it to be suited to horns of different countries or to any particular sound.

The Lucas combined switch and warning lamp is a useful device in the field of accessory lighting equipment. It is of the pull-push variety, containing a festoon bulb and a Perspex lens. The switch may be used in conjunction with reversing lights, fog lamps, long-range driving lamps, defrosters or any unit where indication of operation is desired. An interval warning light is required by law when reversing lamps are in operation. The switch is robust, but attractive, and very easily installed. The Wipac facia switch is of the rotary variety. It is very robust, and has four positions and a special snap-action coupling.

**Instruments and controls**

A.C., Jaeger and Smiths instruments were to be seen in some new styles, prominent among which was the A.C. instrument panel with a neatly grouped layout, which can be easily seen through the steering wheel. The layout includes speedometer, temperature and fuel gauges, trafficator, ignition and oil pressure and main beam warning lights, and a magnifier over the mileage recorder. The Jaeger instruments are internally illuminated either by diffused lights over the entire dial or by a system known as black lighting, which causes the figures and pointer to appear as an incandescent glow. Unlike previous models, the Smiths semi-conductor type of temperature indicator is devoid

*Delco-Remy D200 Series distributor*




*Diagrammatic sketch showing the application of the Smiths model 240 under-seat heater*

**A** *motor switch control* **B** *existing heater* **C** *inlet* **D** *water return*

of bimetal strips and contacts and allows the pointer to fall to its minimum or cold position when the ignition is switched off.

The instrumentation of British and Continental cars, although very attractive, remains conservative by American standards, which are such that speedometer dials, for example, constitute arcs or rectangles of a length approaching, or even exceeding, the diameter of the horn ring. The controls, too, of most American cars are large, widely spaced, and very ornate.

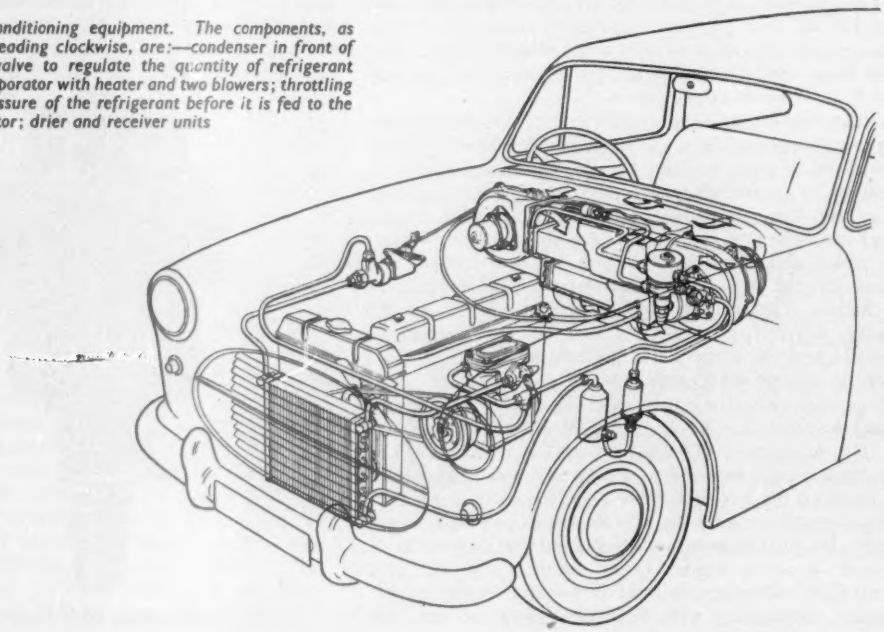
Three comparatively new departures with regard to controls were exhibited. On the Borgward Isabella, the lighting and accessory switch movements take the form of piano keys, which are identified by etched, symbolic drawings on the facia panel. On the Edsel, an electric motor selects the range and engages the transmission following the touch of the appropriate button in a group arranged in the hub of the steering wheel. The Transfluide drive on the Renault Frégate employs automatic electro-pneumatic control for the clutch.

**Transmissions**

The Ford Anglia and Prefect models are now offered with an automatic centrifugal clutch, based on the Newton and Bennett patents. Ford modifications are threefold. Firstly, a gear lever operated switch, called the inhibitor switch, is incorporated, whereby the starter-switch circuit is broken when the car is in gear, so as to prevent the starter being operated under power-drive conditions. Secondly, a push rod, instead of a Bowden cable, operates the blip switch, and thirdly, a lever control is added, so that the clutch can be independently engaged for engine braking on hills, or for a push or a tow start in emergencies. The lever control operates through a dead-centre linkage that causes the clutch springs to engage, instead of to disengage, the clutch under low speed conditions.

In the field of semi-automatic transmissions, the Smiths Selectroshift system is of interest. It is offered as an optional extra on the Isetta Plus and on a number of other small cars of Continental origin, such as the Panhard and Peugeot. For Panhard cars, it is offered under the name of Jaeger. To meet requirements dictated by vehicle design, it is now

*This shows Smiths air-conditioning equipment. The components, as seen from the front and reading clockwise, are:—condenser in front of car radiator; modulator valve to regulate the quantity of refrigerant fed to the compressor; evaporator with heater and two blowers; throttling valve for reducing the pressure of the refrigerant before it is fed to the evaporator; drier and receiver units*



available in two styles, one with a stationary field and the other with a rotating field. A few minor improvements have been made and its use, particularly for small cars on the Continent, is likely to be extensive.

**Heaters and air conditioners**

All the well known ranges of heater were exhibited. There were a few new models but, except for the Smiths 240 under-seat model, they differed from their predecessors only in minor detail or in capacity. There was, for instance, Model B.10/M, a special 5kW fresh air heater developed by Delaney Gallay Ltd. for dual installation in Maserati and other high quality Continental cars. A new unit in the K-L 502 range is for the Vauxhall Victor. Wingard showed a new range of Sahara heaters to suit every popular make of British car.

The Smiths 240 under-seat heater is intended for use where an existing heater is fitted. It is of the recirculatory type, and is designed to provide additional heat for passengers in the back of the car. The main feature of the unit is the provision for demisting equipment to the rear window.

In so far as temperature and humidity control is concerned, the surprise of the Show was the Smiths air conditioning equipment. This is capable of cooling the car interior as well as retaining the advantages of the well known Smiths fresh air car heating systems. The rate of heat extraction when the equipment is being used for cooling is well over 10,000 B.Th.U per hour, which is roughly equal to the input of a large car heater, or that of a 3 kW domestic fire. An incidental advantage of this cooling system is that it not only reduces the temperature of the air, but also its humidity. The air flow through the system is approximately 200 $ft^3$/min, of which approximately one-third is fresh from outside, and the remainder recirculated. The system works on the vapour compression principle of refrigeration, the method that is used in most commercial and domestic refrigerators. In addition to this system, of course, the equipment includes an independent fresh air heating system.

# Coachwork

*Body Styling Shows Modifications Rather than Changes*

THERE was a time when every Motor Show could be expected to produce a variety of new ideas, both in design and construction, but that period has passed. Volume production now necessitates the expenditure of such vast sums for tooling that economic considerations do not encourage manufacturers to re-design, or even modify, their models at set times.

For some years past, modifications have been made, or new models have been introduced, in the earlier months of the year, and therefore an annual exhibition is no longer a "shop window" for entirely new models. As a result of this practice, most of the new models are already familiar to those who follow bodywork trends, and who probably feel that the Show has little new to offer. In some measure this is true, since over the past four years there have not been any radical developments either in the styling or engineering of quantity produced British cars, and it is only in the matter of trim and exterior finish that major changes have been made.

In general, these remarks apply to cars produced in quantity where, as previously mentioned, tooling costs are heavy and there is reluctance on the part of the manufacturer to introduce ideas which may not be readily acceptable by the purchasing public. It is here that the value of individual coachbuilders' work is appreciated. They, with their limited production, can afford to test the feeling of the market by including unconventional principles in an individual production which does not involve any major tool costs. Such a car, when exhibited at the Show will be seen by a large number of authoritative producers, and it is not difficult then to estimate the true value of a new idea which may ultimately find its way into a standard production.

As regards cars produced in quantity, considerable interest was shown in the new range of models announced by Vauxhall Motors, Ltd., for although one of these was introduced earlier in the year, there have subsequently been two new models which show a marked improvement on those seen last year. The latest Vauxhall Velox and Cresta models use the same body shell, which is of integral construction and has been engineered to ensure that the stresses imposed on the structure are equally distributed throughout.

In commenting on the outward appearance of this attractive car, the first impression is that of low overall height, which is 4½ in less than that of the model it replaces. The new Cresta and Velox have an overall height of 4 ft 9 in,

*Low overall height characterizes the new Vauxhall Cresta*

*Special consideration has been paid to luggage accommodation on the new Standard Pennant*

*The Jaguar XK150 coupé has most distinctive lines*

*The Standard Ensign resembles previous models*

this being achieved without any reduction in head room. Another point that appeals is the use of a horizontal moulding extending without deviation from the headlamp mounting at the front to the extreme rearward end of the full flow wing. Here, again, the comparison with the previous model is most favourable, for it will be remembered that at the 1956 exhibition this model was the subject of criticism on the score of excessive use of chromium moulding that lacked continuity.

The screen has a pronounced rearward slope and is wrapped round at each side to flow into the side line of the roof. A point of interest is the unusual shape of the front door. This is necessary because of the forward inclination given to the screen pillars, which in turn necessitates carrying forward the hinge line of the front door on to the scuttle. To give both easy entrance and simple hinging the lower portion of the hinge line is vertical. Both front doors, of course, close on their rearward pillars, as is the usual practice.

Above the waist the doors consist of metal frames, giving lightness with strength. The practice of using a ventilation panel at the forward end of the front door window is followed in this new model. The rear door also is of unusual shape, for the rearward portion of the window extends beyond the shut line to agree with the rearward sloping upper quarter pillar. The rear window is of the wrap-round type, extending to this inclined quarter pillar.

The full-flow wings previously referred to, provide a suitable area at the front for the accommodation of lighting accessories, and a low radiator grille is used in combination with a substantial front bumper to give a pleasing frontal appearance. At the rear there is a capacious luggage compartment, with a lid hinged at the top, but one criticism that can be made is that the spare wheel is carried in a housing with a detachable cover plate beneath the boot flooring. In the event of wheel replacement when the luggage boot is loaded, the luggage must be removed before the wheel can be extracted; it is felt that some further thought might be devoted to this. The accommodation of the spare wheel has for many years past been a problem, but with the alternative positions now being adopted for the fuel tank, there would seem to be some satisfactory alternatives in arranging the spare wheel beneath the boot floor, in such a manner as to give access without disturbing luggage. Trimming can be either in leather or herringbone nylon Elastofab. A point worthy of note is that the front seat has a folding centre armrest.

The Vauxhall Victor, which was introduced some months ago, bears some similarity in screen layout to the more

*This new 2·6 litre Riley has a particularly well finished interior*

*Below: A revised frontal aspect has been adopted for the Hillman Minx Jubilee saloon*

*Available in a wide choice of colours, the Wolseley Fifteen Hundred provides a high standard of comfort*

recently introduced Cresta and Velox models. The Victor is a smaller model and is less attractive in appearance, being reminiscent in many respects of the current American styling which finds less favour on small cars in this country.

A display that always attracts is that of Jaguar Cars Ltd., and on this occasion it proved no exception. A new model which well repays a close study is the XK150, which in coupé style is available with fixed or folding head. In each case, there are front seats for two passengers, while a third adult passenger or two children can be accommodated at the rear. Externally, in the traditional Jaguar manner, the body has very attractive lines, its low roof and swept bonnet panels harmonizing agreeably with the full-flow wing treatment, which is devoid of external moulding treatment and is the more appreciated on that account.

Turning first to the fixed-head coupé, much of the light appearance is accounted for by the metal framed door tops, which at the front embody the customary ventilation panel. In addition to the full-drop door window, there is a hinged quarter window which has a curved upper line to harmonize with the well swept roof line. There is a wide rear window and although it is not of the conventional wrap-round form, the Jaguar arrangement is such that strength is retained in the more conventional roof formation. This is a steel panelled body, but to save weight, aluminium is used for the boot lid and bonnet. A curved wrap-round windscreen is used, and below the waist line a vertical line is maintained for the door hinge. The pronounced downward sweep towards the front of the bonnet panels gives a low radiator grille, with headlamps blended into the inner wing valances.

In the past Jaguar models have been notable for their interior finish, which has been enhanced by the use of walnut cappings, but in this new model these cappings are leather-covered. Although some enthusiasts might regret the omission of walnut, the new styling is pleasing and corresponds to the foam latex padding used along the base of the screen. The drop-head model is similar in many respects, with a head that folds neatly around the rear compartment. It is not concealed by decking.

Two new models shown by The Standard Motor Co. Ltd. were the Ensign and the Pennant, both of which are based on models that have achieved success. The Ensign carries the Vanguard III a stage further, and for this new model the front has been restyled. The features of the Vanguard are well known and for the new model there is additional interior equipment. The Pennant is a smaller model based on the Standard Ten, and in considering this new model some reference must be made to the external moulding used on the side panels, doors and rear wing. This moulding, particularly on a car finished in contrasting colours, appears to lack continuity, for although it maintains a horizontal line on bonnet and doors, it is downswept at the front of the rear wing and assumes its horizontal application at a lower level as it passes towards the rear. It is, of course, realized that since the main portion of the moulding is below the level of the top of the wing, it is impossible to maintain a horizontal line throughout the length of the body, but the styling used is not in accordance with the prevailing trend

in which the moulding on meeting the rear wing, is upswept to follow the upper line of the wing, so that if contrasting colours are used, the entire mass of the rear wing is in one colour, which would seem to be a more harmonious arrangement. Special attention has been devoted to luggage accommodation in this Pennant, four-door four-light saloon, and in addition to a lid giving access to the luggage boot, it is possible to gain access by hinging the rear squab forward.

Some months ago Wolseley Motors Ltd. introduced a new model, the Fifteen Hundred, which in saloon form carries a four-door four-light body. It can be said that this follows restrained styling, having a curved screen which is not of the wrap-round type, although in appearance the car suffers little on this account. There is a capacious luggage boot and the interior of the body is roomy and well appointed, folding armrests and loop type door pulls being available if required.

Externally, the lines of this car are pleasing, a two-tone colour scheme being divided by a horizontal moulding extending from a point just above the front wing and passing to the rear without any break in continuity. On this model, as on others in the exhibition, the front end of the moulding terminates abruptly on meeting an inclined moulding carried up with a forward slope from the underside of the front wing. This inclined portion is devised as a motif to give a definite point on which to start the body side moulding and to complete the lower panel area to be finished in an alternative colour.

Expressly designed to facilitate the carriage of lengthy articles, the rear seat squab is hinged, giving access to the luggage boot and on occasions permitting long articles to extend from a point immediately behind the rear of the front seats to the full limit of the luggage boot. The luggage boot has a rear lid hinged at the top and supported by a side stay.

Those concerned with body engineering found an interesting study in the A55 body frame exhibited by the Austin Motor Co. Ltd. This body frame, partly sectioned, was mounted on a slowly-revolving turntable, displaying in turn the near-side of the body complete with doors, and then the off-side more fully sectioned to indicate reinforcement members, and so on.

The new Riley Two-point-Six saloon is a model that, as the product of a big motor corporation, utilizes some of the pressings that form the basis of another model. There are slight external changes, of course, and the interior appointments are different. This new Riley is a worthy successor to the Pathfinder model which it replaces. The full-flow wing carries a moulding running from end to end to form a dividing line for the two colours used. A feature to be found on this car and one which must appeal strongly to drivers, is the use of an adjustable front seat combined with a steering column that is adjustable for length. Another fitting which could be more widely used and which is to be found on this new Riley is the visor panel that can be used to protect the eyes from glare through the windscreen, but can also be swivelled to give protection from strong light through the front door windows.

In the model which it replaces the bonnet top panel was hinged at the rear and was integral with the radiator cowl; in this new model the rear hinging is retained but the radiator cowl is separate and remains in position when the bonnet is raised. Beneath the boot floor the spare wheel is carried in a cradle that is lowered and withdrawn when it is necessary to change a wheel, whilst the boot lid has a lock which is operated from within the car. The interior has a high grade finish, with leather upholstery and walnut cappings, and the specification contains a feature that is becoming increasingly popular, this being a sponge rubber-filled leather trim pad or bolster, extending from side to side as a windscreen finisher. This gives protection to front seat passengers in the event of severe accident or sharp deceleration.

A model which has achieved considerable success in its

*An outstanding Continental design by Gebr. Beutler shown on a Bristol 400 chassis*

*Convertible coachwork is now available on the Singer Gazelle*

various forms over the past 25 years is the Hillman Minx; in the latest version only minor changes have been made. Externally, the main difference is to be noted in the styling of the front end, where a lattice-work grille is now to be observed. Further additions have been made to interior fitments and a worth while item is the courtesy light, which is controlled by the front door.

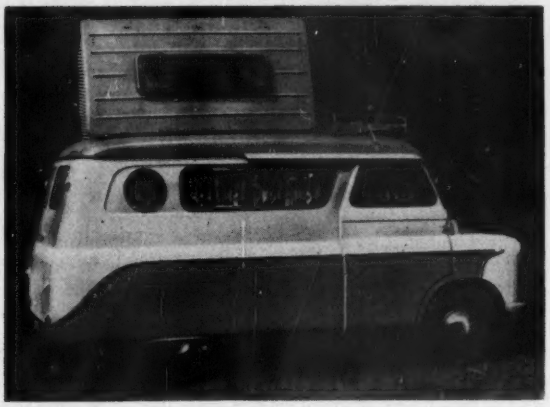
Since their introduction a few years ago, Bristol cars have particularly appealed to the body engineer. The reason for this interest is that in their construction aircraft principles have been employed. This method has been used with considerable success, as is to be seen in the 405 model, which shows little change. The 406 type had a body styled and built by a Continental coachbuilder, a procedure that is becoming a regular fashion with high-class British car manufacturers. This latest Bristol model is a two-door sports saloon styled and built by Gebr. Beutler, a well known Swiss coachbuilder. It is noteworthy for its clean lines and a roof structure that offers minimum obstruction to the vision of the occupants. As has been noticed in other models designed on the Continent, the transverse roof sweep occupies minimum depth, and this also enhances the roof structure's appearance of lightness. Full-flow wings are employed and it is observed that the forward portions of the wings commence at a lower point than those of comparable British cars and are given a gentle curvature to attain maximum height at the door. Behind the door shut line the full-flow wing sweeps downwards; the effect of this wing styling is to give an appearance of lightness that is sometimes lacking in our full-flow wing treatment. To harmonize with this forward wing sweep, the bonnet panels have a downward sweep towards the front, being broken only by the inlet for cool air, which is situated approximately midway between the screen and radiator grille. The low expanse of the forward ends of the front wings provides a neat housing for the headlamps, below which auxiliary lights are mounted, while the radiator grille contains a pass lamp at either end. This is an outstanding car, of considerable interest to coachbuilders.

To suit our variable climate, the convertible body has found many adherents and most car manufacturers are able to meet the need should the occasion arise. When introduced last year, the Singer Gazelle carried a two-door, four-light saloon body, but there has now been added to the Gazelle range, a very attractive convertible style which well repays close study. This new model is a two-door body having a three-position head, the head mechanism when lowered being accommodated in a recess on three sides of the rear seat, in which condition the car has a very neat appearance. It is possible to accommodate three persons on the front seat which, to give access to the rear compartment, has a divided back that not only hinges forward but, with offset hinges, is angled at the same time; this is a very desirable arrangement. It is considered that the rear seat will accommodate two adults, and even with the front seat adjusted to its rearmost position, there is comfortable knee room for the rear seat occupants. There is a useful luggage compartment at the rear.

An entirely new model displayed by a concern who have built up an excellent reputation on racing circuits and who have previously only produced open sports cars, is the Lotus Elite, a two-seater sports coupé which should have a wide appeal amongst sporting motorists. This new sports body, like so many others in this category, is of plastics construction with structural members reduced to a minimum. It is interesting to find that the main consideration in the matter of strength has been devoted to the scuttle unit. It has for a long time been realized that transverse rigidity at this point is vital to counteract stresses arising from poor road surfaces, which inevitably have a detrimental effect on steering and readily transmit vibration to the body if the scuttle is not strong enough to counteract them. In the past this has been the main consideration when convertible coachwork was under consideration, and much has been learned in this important matter.

It is, therefore, interesting to find that in this new plastics panelled Lotus coupé a tubular steel reinforcement is used at the scuttle. The manufacturers have gone to some considerable trouble to find a plastics material that retains all the qualities of lightness and ready adaptability to the involved shapes now found in the car body, while yet giving the necessary strength to enable structural members to be reduced to a minimum.

Concerning the design itself, the Lotus coupé embodies the full-flow wing treatment, combined with a pleasing downward curvature of the bonnet panels towards the front end where the radiator grille is low and unobtrusive. The curved screen has ample inclination and behind the two



*Above: A salient feature on the Bedford Dormobile by Martin Walter is the extending roof that gives caravan headroom*

*Attractive wing and body treatment is used on the new Lotus coupé*

*Because there is no upper centre pillar, this Mercedes-Benz has unobstructed window area*

front seats there is adequate space to accommodate twin spare wheels beneath a parcel rack.

An example of plastics construction on a larger scale was to be found in the Jensen 541 saloon which was displayed at the previous exhibition and has only received minor modifications.

The versatility of the Dormobile produced by Martin Walter Ltd. is well known, for it has been marketed for some years. The idea has now been carried a stage further and much interest was aroused by the Dormobile caravan. For many people this will provide more convenient caravan conditions than would a trailer, and in making this car the difficulties of caravan towing conditions are foremost in mind. As a rule it is impossible to provide all the facilities for comfortable caravan living in one vehicle unless it is very large, but in the new Bedford Dormobile caravan an ingenious extension of the roof enables adequate headroom to be obtained in a vehicle of normal height.

The Bedford Dormobile is based on the standard Bedford 10/12 cwt van and, to provide an interior head room of 6 ft 11 in, a section of the roof is mounted on telescopic slides and may be pushed upwards to the desired height, the sides and ends being positioned in the same operation. When retracted, the roof extension is barely visible and the vehicle might well be taken for a normal type van, with the exception, of course, that there are large side windows in the rear compartment and also a small circular window towards the rear. Excess luggage can be accommodated in a roof rail over the front compartment.

Seating accommodation is provided for six persons, but it is possible to re-arrange the seats to form two single bunks or, if desired, one double bunk.

The Bedford Dormobile is provided with the normal caravan equipment, a double-burner stove being located in the off-side rear corner of the body, where there is, of course, the usual access through a door in the rear panel. When not in use, the cooker may be enclosed in a washable, plastics-covered top lid. For privacy, the side windows are provided with curtains. There is a plastics washable sink alongside the cooker, with outside drainage. This unit is also enclosed when not in use.

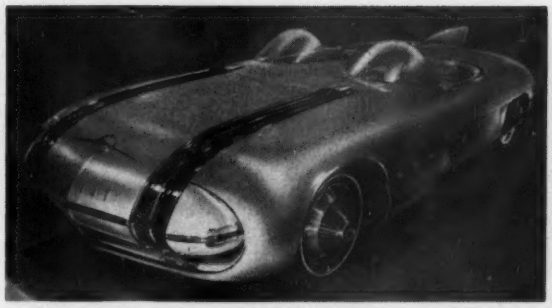
The pillarless idea is not new to coachbuilders in this country, but has not been seen for some years, although it does provide some very useful features. It is, therefore, interesting to record that there is now a Mercedes saloon which, while not giving full pillarless conditions, provides some of the advantages associated with this principle. As will be remembered, to give a pillarless body it was necessary for both doors to close on the central pillar, but the modern door arrangement is one giving doors that close on their rear pillars. To retain this current arrangement, which has a worthwhile safety factor, Mercedes have used a half

*Below: Rear panel entrance to the rear seats on the Janus*

pillar, which extends from the sill to the waist line, giving hinging for the rear door and a closing edge for the front door. Naturally, since this pillar terminates at the waist line and is heavily stressed, it has been necessary to use a very stiff component and the pillar is composed of T-section steel. The windows are metal framed and abut in the centre to exclude draught and rain. This seems to be a worth while idea, for it provides shoulder space when entering the front seats and the absence of a pillared top gives the impression of length and low height to this car.

A very good example of the use of plastics for body construction was to be seen in the Electron Minor, a pleasing sports two-seater of small engine capacity. The attractive two-seater body has the full-flow wing treatment, with the headlamps mounted in forward extensions of the front wing panels, and as in the case of the Continental styled Bristol, the forward portions of the wings are downswept, harmonizing with the bonnet panels, which are low and also have a downward sweep. There is a curved screen and the tail panels are low and well swept to combine with the forward mass in giving a well balanced external appearance. For the single side doors, external hinges are used at the front, these hinges being faired and chromium plated to provide a decorative effect. The manufacturers have made a close study of plastics material and have been successful in obtaining one which needs little reinforcement, with the result that the complete vehicle has a dry weight of 895 lb. Its performance, therefore, should be extremely good.

One of the features of the exhibition was the increasing



*Independent windscreens are fitted on the Pontiac Club de Mer*

*Great interest was shown in the plastics panelled Meadows Frisky*

number of miniature cars which have been seen on the Continent during the past few years and are now attracting the attention of manufacturers in this country. A type which has a number of attractive features is the Heinkel which represents a completely new line of thought in vehicle design. For example, there are no side doors, the entire front panel complete with windscreen being hinged on one side, making it possible for front seat passengers to enter from the front. The steering wheel and pedals remain in position and present no real difficulty. Behind the front seat, which accommodates two persons, there is space for luggage or for small children, who gain access to their seats by climbing over the hinged-down front seat back. Since there is little in the way of solid panelling above the waist, there is excellent visibility from all seats, curved plastics material being used for the windows. There are ventilation panels at each end of the side window surfaces.

Similar in general outline is the Janus 250, which has an opening front panel giving easy access to the two front seats. However, for access to the rear seats, which face rearwards, the rear panel can be opened, thus avoiding the necessity for climbing over the front seat squabs. This is a most unusual arrangement, but it does enable the car to be used for carrying luggage, and it can, in fact, be made to accommodate a perambulator.

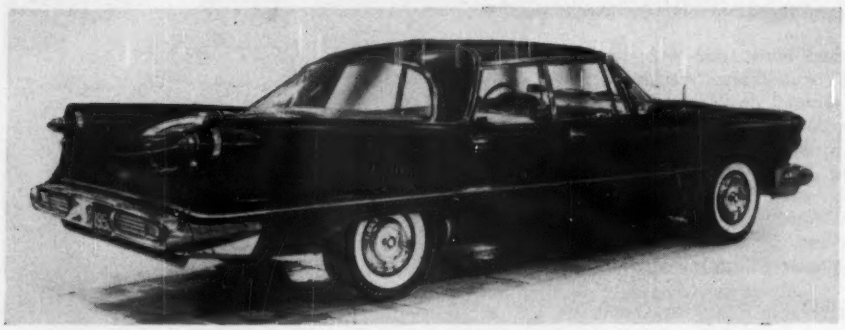
After viewing these two interesting examples of miniature cars, it is felt that they possess worth while features which should be given careful consideration by any who contemplate producing a miniature saloon car. Quite obviously, it would be impossible to embody many of the conventional saloon car features, but invariably the purchaser makes allowance for this factor when considering the low purchase price associated with this type of car.

The Janus was displayed with Pontiac exhibits, and one of these that attracted attention was the Club de Mer, a small sports two-seater of streamlined appearance, notable for the fact that it possesses individual screens for each of the front seat occupants. These well curved screens leave an open space in the centre, but on a car such as this with purely sporting characteristics, the individual screens will doubtless prove adequate.

A small car produced by Henry Meadows Ltd, to compete with small cars from the Continent, is the Frisky, which follows more conventional lines. For example, the doors are in the side panels and seating is more conventional. Accommodation is provided for two adults on the front seats, and it is possible for three children to occupy the rear seat. With the full-flow wing treatment, spaced at the front by a normal type of bonnet and grille, this car follows more closely a conventional outline.

American car manufacturers continue to exploit the long low full-flow wing, which is invariably ornamented by an excessive amount of chromium plate. An example of current American practice was to be seen in the Chrysler Imperial four-door saloon, with coachwork by Le Baron. The car in question is long and low, with ample interior dimensions to give maximum comfort under all conditions. The windows are power-operated and there is very complete interior heating and demisting arrangements, which take into account the rear window. This all-steel body has a front seat with ample adjustment, and folding centre armrests are used on both front and rear seats.

The practice of extending the rear wings to provide stability fins has for some time been a feature of American cars, and although new models have yet to be announced, the Chevrolet is an example of this current trend, which to



*This Chrysler saloon has very large window area*

a limited extent is being followed in this country. These wing extensions provide convenient housings for electrical auxiliaries, as in the Chevrolet, for example.

With one or two notable exceptions, the specialist coachbuilding industry has been dependent on a few car manufacturers, and this continues to be so. Thus, in the coachbuilding section relatively few chassis were represented and these mainly were of the high-quality type. Vanden Plas for example, being part of the large B.M.C. undertaking, exhibited only bodies on Austin chassis, and these bodies form part of the regular Austin range. Similarly, Hooper and Co. are concerned mainly with Daimlers, and Park, Ward and Co. with Rolls-Royce. Although these stands occupied by specialist coachbuilders invariably showed a product that forms part of a standard range, they also displayed special coachwork that made an interesting study.

Dealing first with the Rolls-Royce and Bentley listed products, the main thing to be noticed was that the Rolls-Royce Silver Cloud is now available with a 4 in longer wheelbase, a modification that has been made to enable the interior body space to be lengthened and permit the use of a division with drop glass between front and rear seats. It has apparently been found that there is a demand for a Rolls-Royce Silver Cloud in which the car is driven during the week by a chauffeur, but is used at other times for purely private purposes when, with the division glass

*Rear wing formation on the Chevrolet Bel-Air*

with divisions, no attempt has been made to provide fore and aft adjustment for the front seat. This matter was considered at some length, but eventually a compromise was achieved which seems to have given general satisfaction. It should perhaps be mentioned that some years ago adjustment was provided for the front seats of a limousine, but the records show that this adjustment was never used and is, therefore, considered quite unnecessary.

*A lengthened wheelbase on the Rolls-Royce Silver Cloud permits touring limousine coachwork*

*Picnic requisites are neatly housed in the door of the Park Ward Bentley Continental*

lowered, it has the appearance of a normal saloon car. This new touring limousine has been produced from the standard panels which provide the shorter wheelbase Silver Cloud saloon. The additional 4 in has been added to the width of the rear door, roof and sill. All other body units are exactly the same as those used in the Silver Cloud saloon, but the interior, of course, is styled to suit the dual purpose nature of the car.

Some examples of this revised body style were to be found amongst the cars exhibited by individual coachbuilders and James Young Ltd., for example, displayed a touring limousine designed without recourse to existing panels. This is a most attractive car in which the additional 4 in has been divided between front and rear doors with, it is felt, a more pleasing balance between front and rear door windows. As in the case of the standard touring limousine shown by the chassis manufacturer, the division window is electrically operated, having the control button in the centre of the division itself.

It is noted that here, as in all the new lengthened bodies

Another new type exhibited by James Young Ltd., was a Bentley four-door saloon that constitutes a four-door version of the Bentley Continental, two-door saloon. It is attractively styled but as in other examples of the four-door Continental saloon on display, it seems to lack the distinct and very sporting appeal of the original two-door Continental model.

It is interesting to note that James Young include in their specifications a safety strap to reduce the possibility of accident to front seat passengers. This safety strap embraces the waist of the passenger and holds the passenger securely in the seat, despite rapid deceleration. It is understood that this feature is used on Rolls-Royce and Bentley cars exported to America.

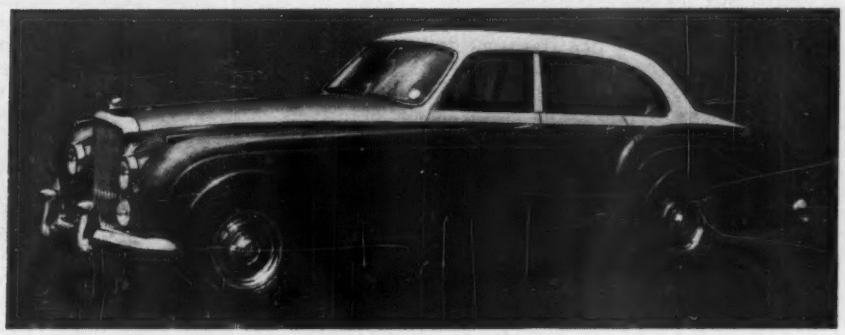
The exhibits displayed by Park, Ward and Co. Ltd. showed relatively little change, but detail modifications have been made and one of these is the neat housing of picnic requisites in the front doors of the Bentley coupé. Some thought has been given to this matter and instead of accommodating various picnic utensils in a haphazard way, each door contains at its front end a deep recess that houses a fitted case, which is completely concealed by a sliding panel. Thus, when dirty, utensils can be carried away from the car as a complete self-contained unit. Both fixed-head and folding versions of the Continental coupé were exhibited by this coachbuilder, who also displayed the latest styles of Rolls-Royce coachwork.

The question of weight is one to be considered very carefully in cars designed to exceed 100 m.p.h. It is interesting to record that in their new four-door sports saloon which bears the title of Flying Spur, H. J. Mulliner Ltd., who built the original two-door Continental Bentley, have succeeded in keeping within the two-door weight limit for their new four-door body on the same chassis. This is a noteworthy achievement when the extra door furniture is considered, and the new model which has the clean and smooth appearance of the original type, is a commendable addition to the range of cars with which Mulliners have long been associated.

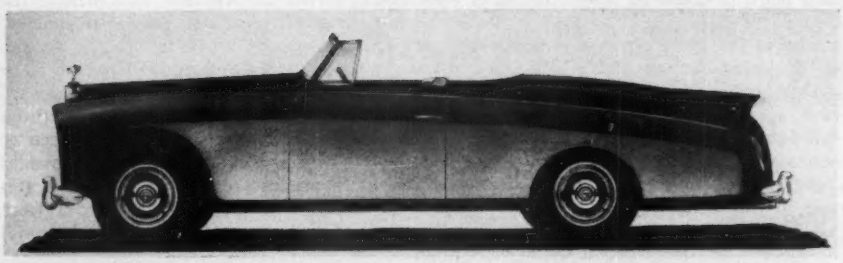
On a Silver Wraith limousine which this coachbuilder displayed, some slight modification has been made to the rear compartment, in which the depth of the rear seat cushion has been reduced by one inch to improve knee room between the rear seat and the sides of the centre-facing occasional seats. This modification appears to have been successful, for there is no suggestion of restricted knee or leg room when seated on the rear cushion and with the occasional seat lowered. Also the loss of one inch in the depth of the rear seat cushion has not materially affected comfort.

The Silver Cloud long wheelbase touring limousine exhibited by Hooper and Co. (Coachbuilders) Ltd., has an unusual feature which can be included in a specification or omitted without affecting either design or construction. This is a step at the base of the rear door rocker panel to bridge the gap between the pavement and the body floor, a distance that does not normally cause undue concern, but might in some cases be improved by the type of step which Hoopers have devised. The step is actuated by the rear door, the opening of which causes the narrow step, having a maximum width of 7 in, to slide from its recess in the rocker panel and provide a foothold for an ascending passenger. In these days when running boards are no longer in vogue, the need for easing the step into the car is sometimes overlooked, and this Hooper innovation is viewed with interest.

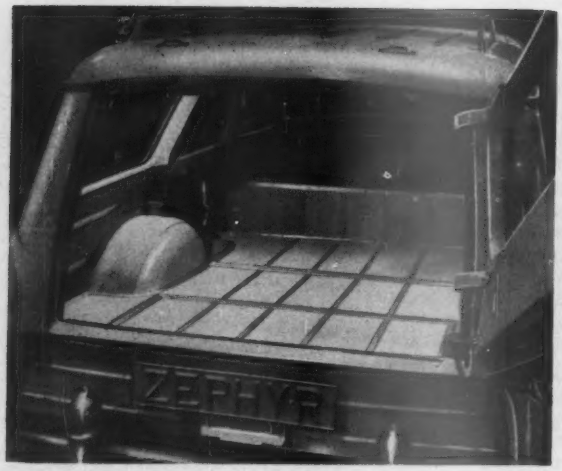
*Door-operated auxiliary step on Hooper Rolls-Royce limousine*



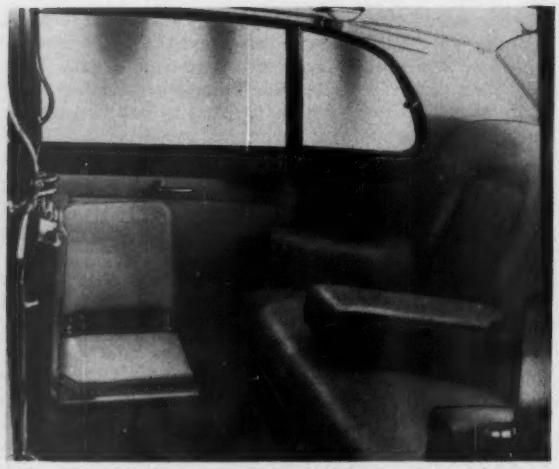
*Four-door sports coachwork by H. J. Mulliner Ltd., on Continental type Bentley chassis*



*The head and concealing deck are power-operated on this Rolls-Royce Silver Cloud manufactured by Freestone and Webb*




*With the rear seat folded, the E. D. Abbott Ford Zephyr provides a roomy luggage compartment*



*Slightly reduced rear cushion depth on H. J. Mulliner Silver Wraith limousine gives greater leg room*

Possibly the most unconventional design in the Show was the convertible body shown by Freestone and Webb on a Rolls-Royce Silver Cloud chassis. This is only a two-seater body, and in the space behind the front seats there is accommodation for luggage in addition to the room available in the long tail panels. The folding hood is power-operated, a method of operation that is also used to actuate the decking which is used to conceal the folded head. Thus, operation of a single switch causes the decking to rise to the maximum extent, upon which the head commences to fold, eventually coming to rest quickly and easily in the recess provided. With the head in this position, the decking automatically closes down to give a flush appearance to the forward end of the rear boot. This hood mechanism is powered by a combination of electric and hydraulic units, but for the door windows Piper electric mechanisms only are used.

As regards external appearance, this Silver Cloud convertible body is notable for its long full-flow wings; there is, of course, only one door on each side.

The estate car displayed by E. D. Abbott Ltd., on a variety of Ford chassis is not a new style, but one of the models displayed was that on a Ford Zephyr in which some care has been taken to improve the positioning of the rear seat when folded away to allow the maximum amount of luggage to be carried. This is so arranged that it is first possible to hinge forward the seat cushion, which rests against the back of the front seat and presents a metal-protected rear face towards the rear. The rear seat squab, which also has protection on the back in a material which corresponds with that used on the main luggage floor, is then hinged forward and when fully lowered provides the forward extension of the main boot floor, coming to rest with its forward edge in close proximity to the cushion base previously folded. This gives a long unimpeded area of rear flooring, with the advantage that the rear seat, which helps to create it, does not lack comfort in any way.

The result of a critical examination of the many types of bodies in the exhibition indicates that during the past twelve months there has been little change, either in styling or body engineering. The outward appearance of bodies continues to be dominated by full-flow wing treatment, in which the front wing without reducing overall width passes over the front and rear doors and merges with the rear wings. Some slight improvement in this wing treatment was to be found in both British and Continental examples in which the high wing-line previously used was discarded in favour of a treatment that started low at the front, rising to full height at the centre pillar and reduces again towards the rear. Invariably this treatment was combined with a downward sloping bonnet top which gave a harmonious effect and must improve forward visibility from the front seats. It is to be hoped that this slight refinement will find increasing favour on British productions.

Body engineering continues to follow accepted lines and for cars produced in quantities, steel continues to be the favoured panelling material, although since such cars are extensively tooled, it inevitably provides the main structural strength, unitary construction being employed. For less highly stressed areas, the practice of using aluminium on such items as bonnets, boot door and roof panels continues as before. This, of course, reduces weight.

There has been no real increase in the number of cars using plastics as a constructional material, and this interesting substance was mainly found on small cars where a low engine capacity necessitates a close examination of overall weight. It should here be recorded that comparison between the plastics panelled bodies showed a marked difference in finish, and it is obvious that to obtain an unblemished panel surface to compare favourably with a metal panel, careful selection and panel forming operations are required.

One aspect of design that still needs consideration is that of spare wheel accommodation, and it is to be hoped that the day is not far distant when this troublesome piece of equipment may be discarded. Such a decision is not within the province of the body designer, to whom the spare wheel has long been a problem, but so long as it is considered a necessary item of car equipment it must be assumed that the wheel may at any time be needed and it should not, therefore, be hidden under a mass of luggage. The best arrangement would appear to be one that is favoured by some manufacturers who, having moved the fuel tank from beneath the boot floor to the back of the rear seat squab, are able to mount the spare wheel in a hinged cradle that can be lowered by a wheel-brace or jack handle to permit the wheel to be withdrawn from beneath the rear bumper. The rearward portion of the front wing would appear to offer possibilities for spare wheel accommodation, and has in fact, been so used in the past, but with the contraction of the forward portions of the car in the interests of weight distribution, it is rarely possible to obtain sufficient length between front wheel and door-line to accommodate the spare wheel without raising it to an undesirable height.

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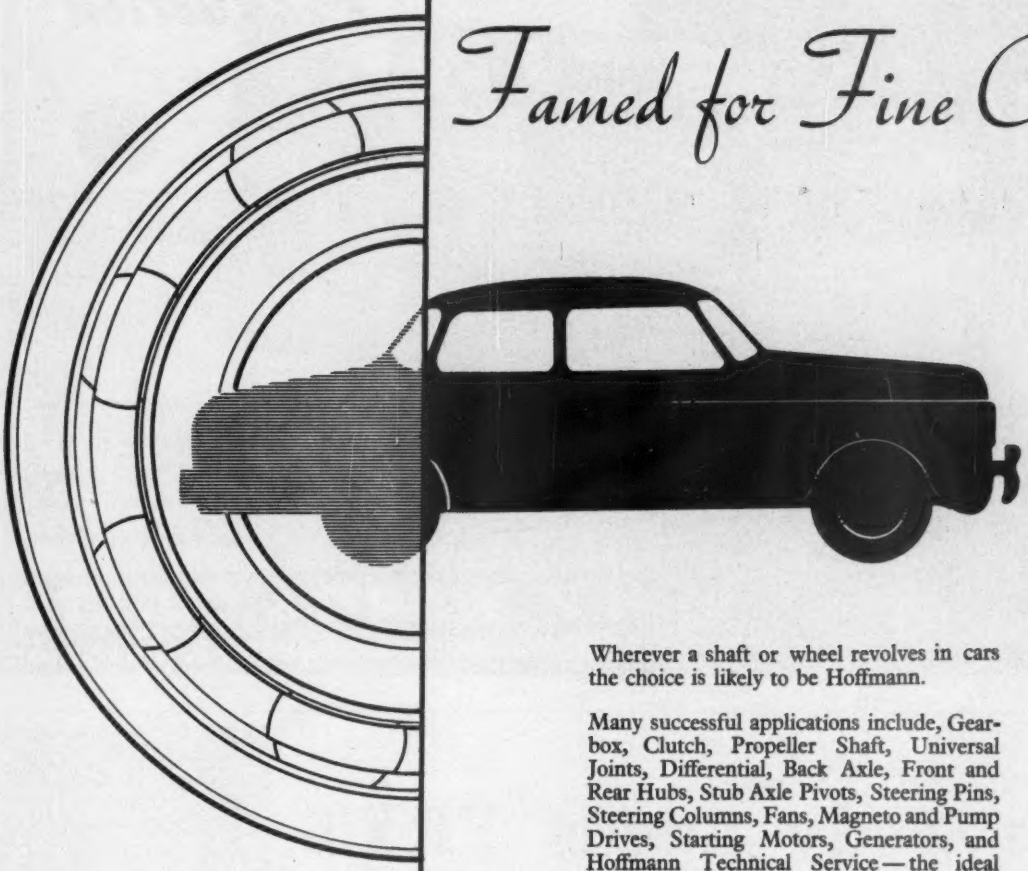

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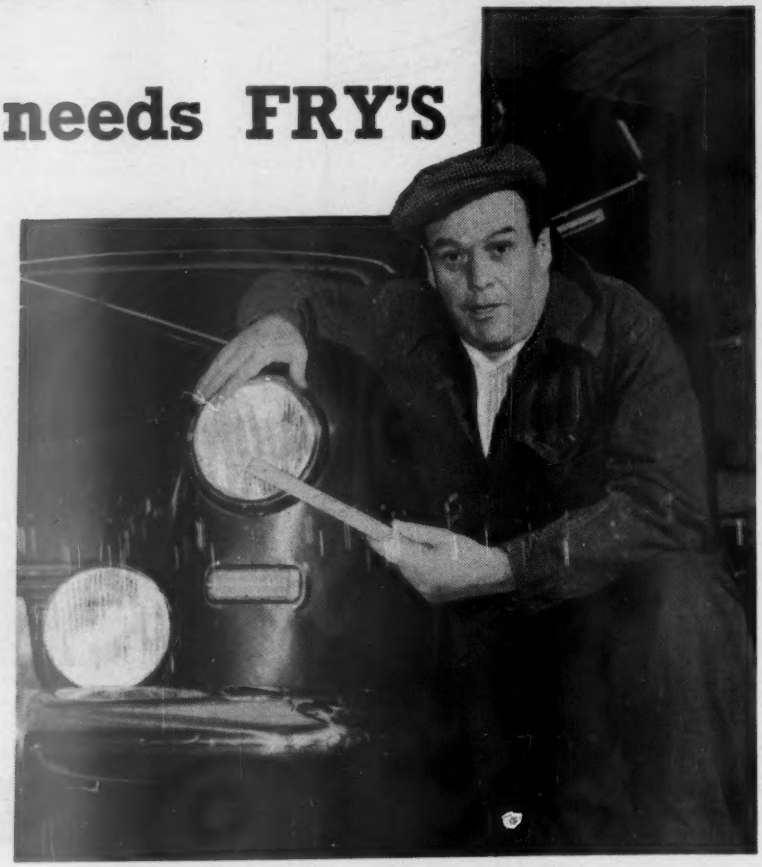

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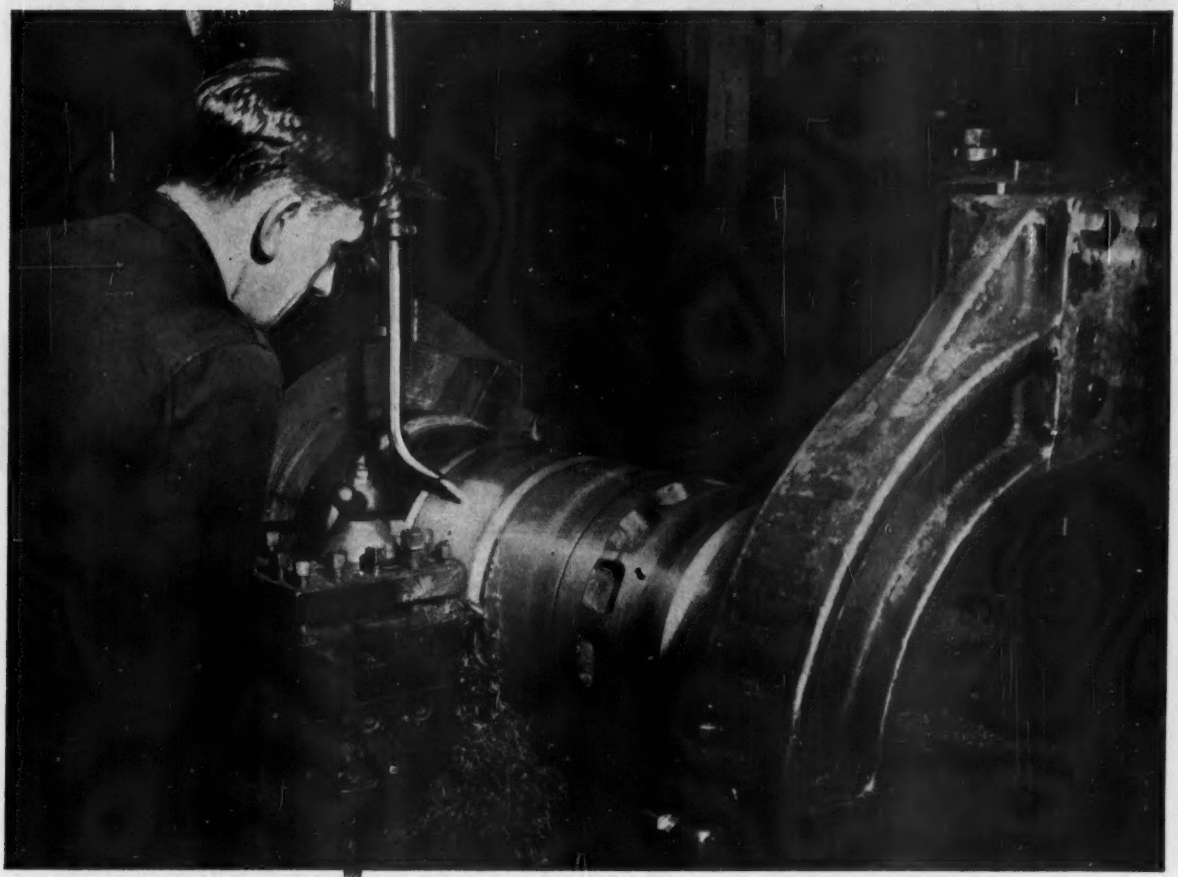

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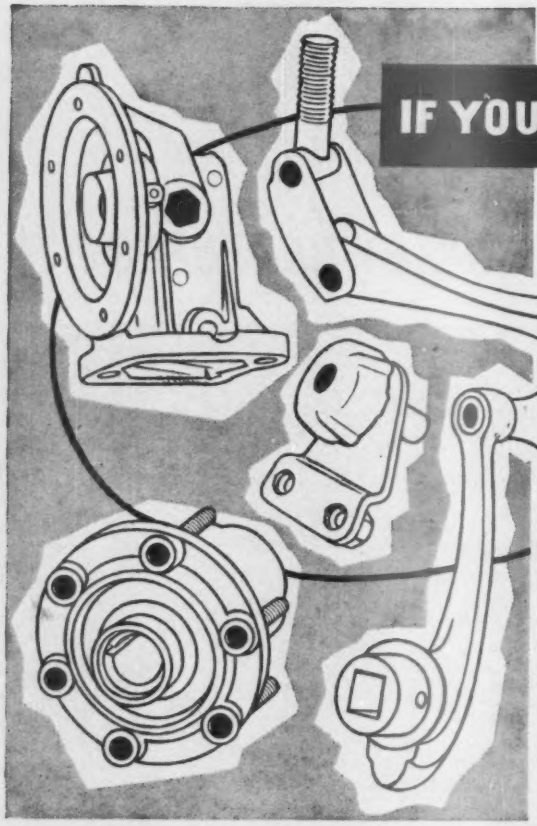

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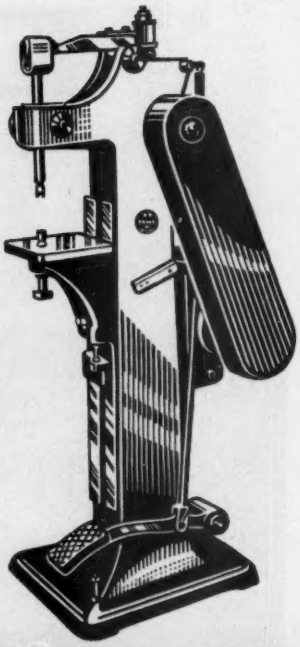

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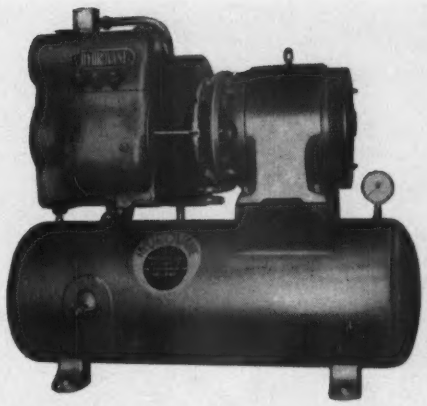

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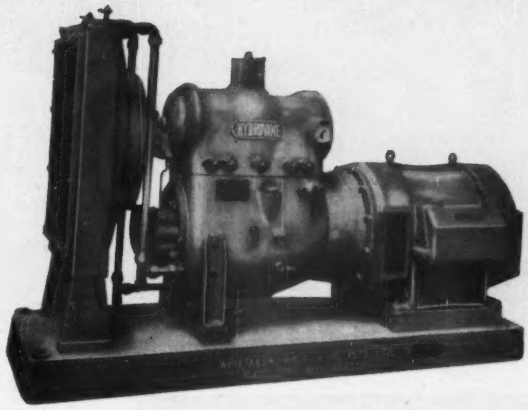

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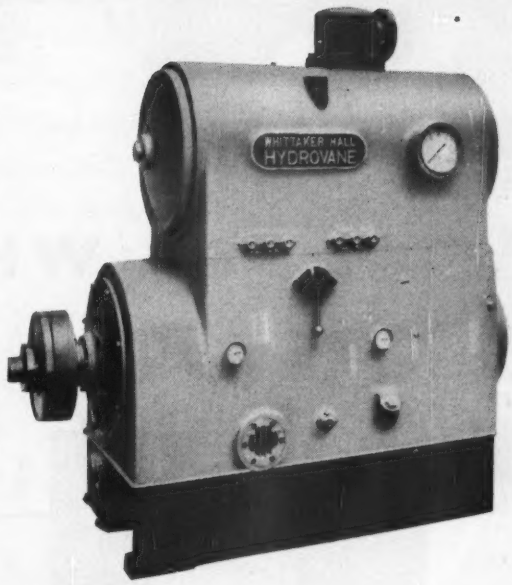


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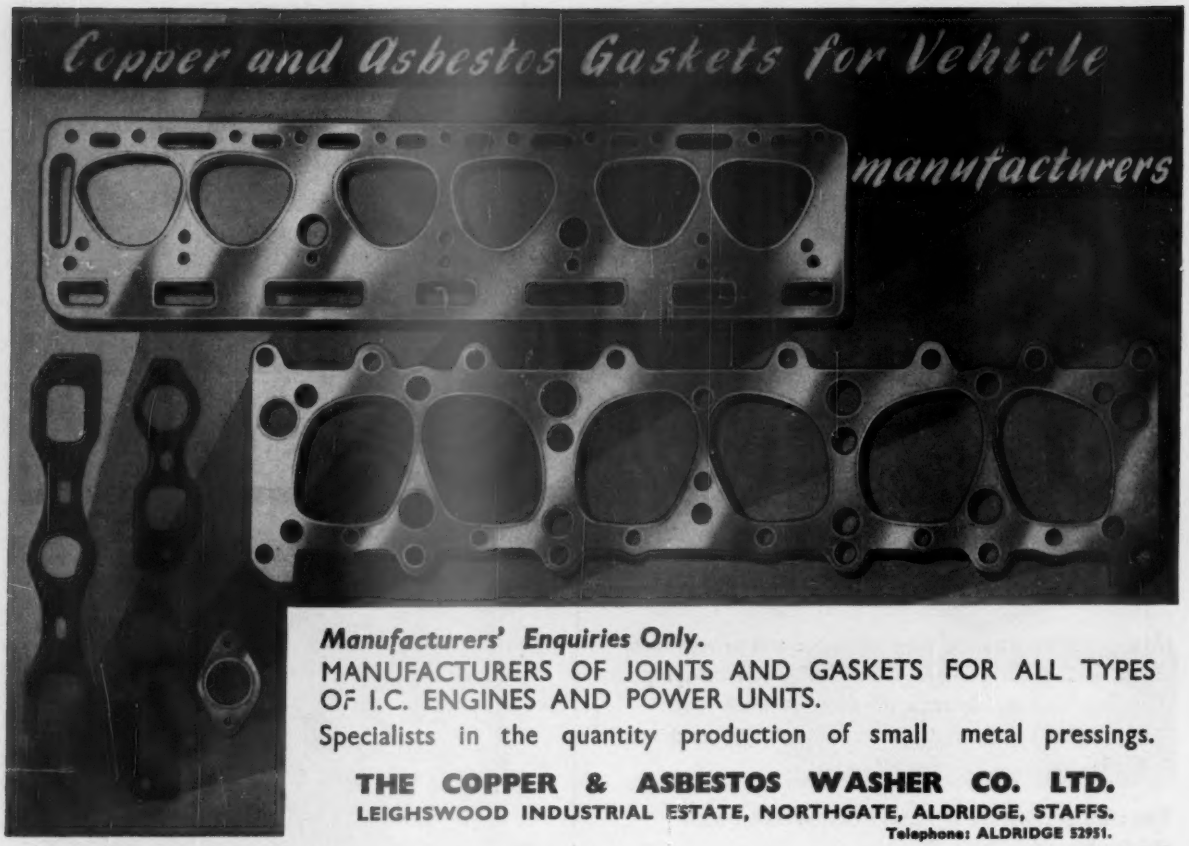


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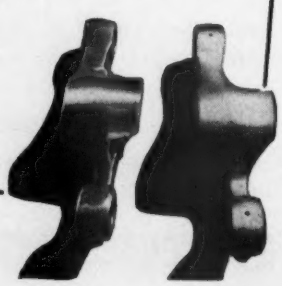

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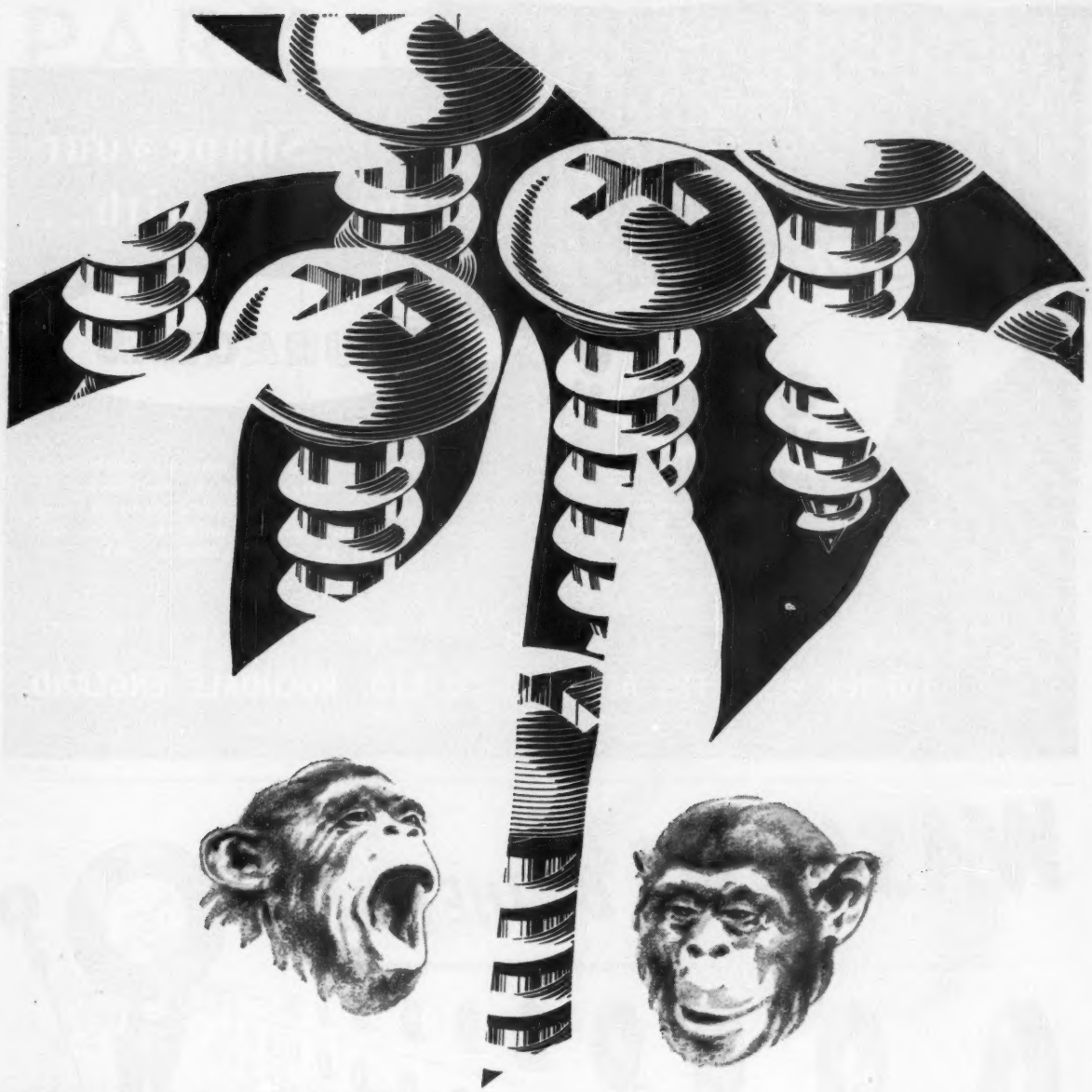

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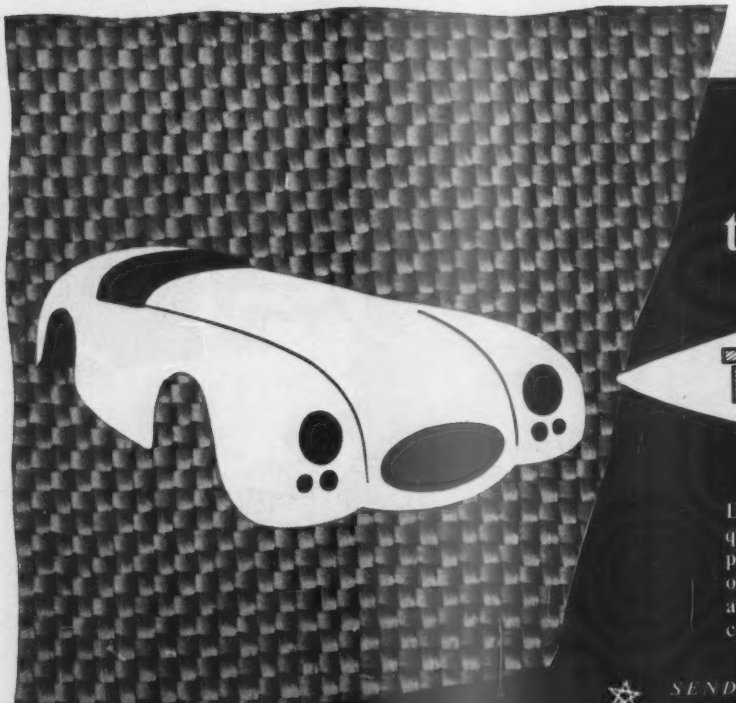

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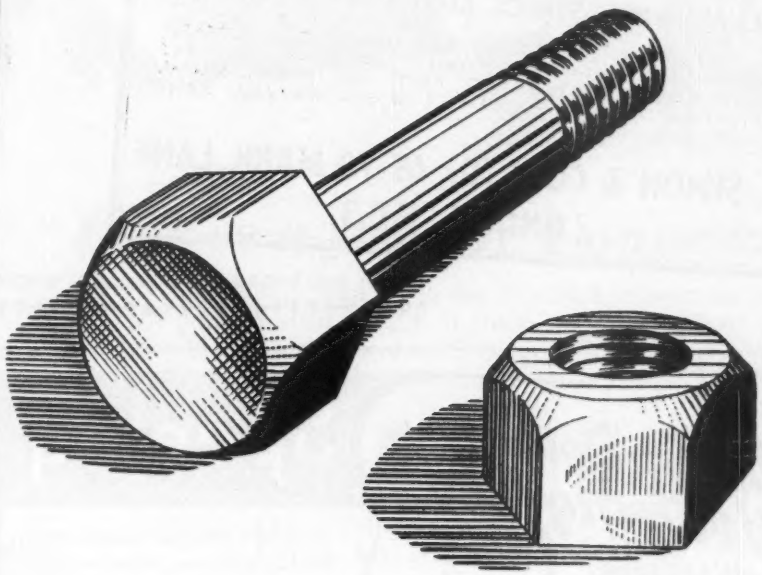

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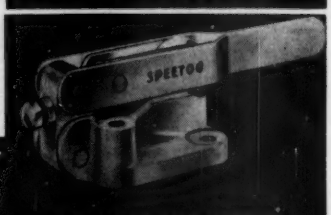

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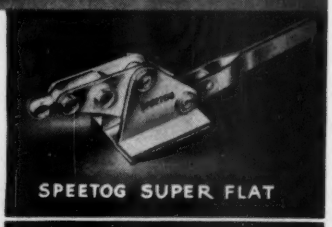
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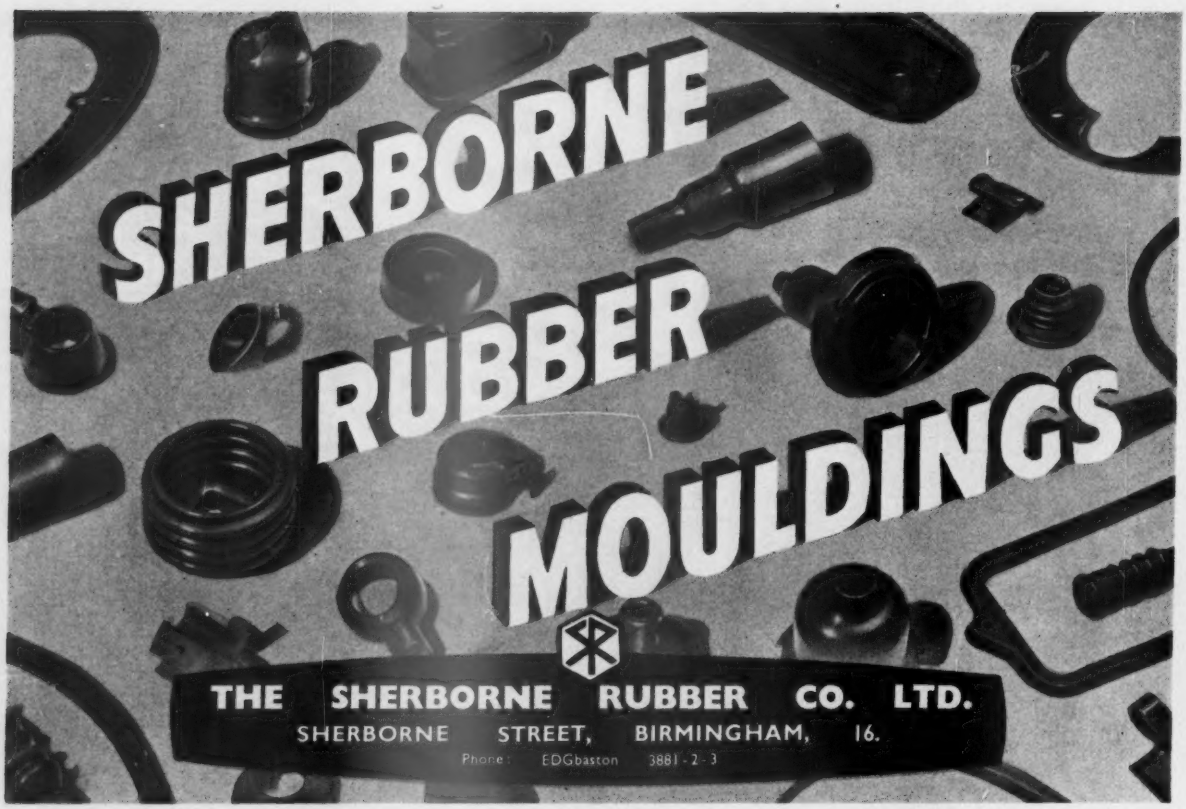

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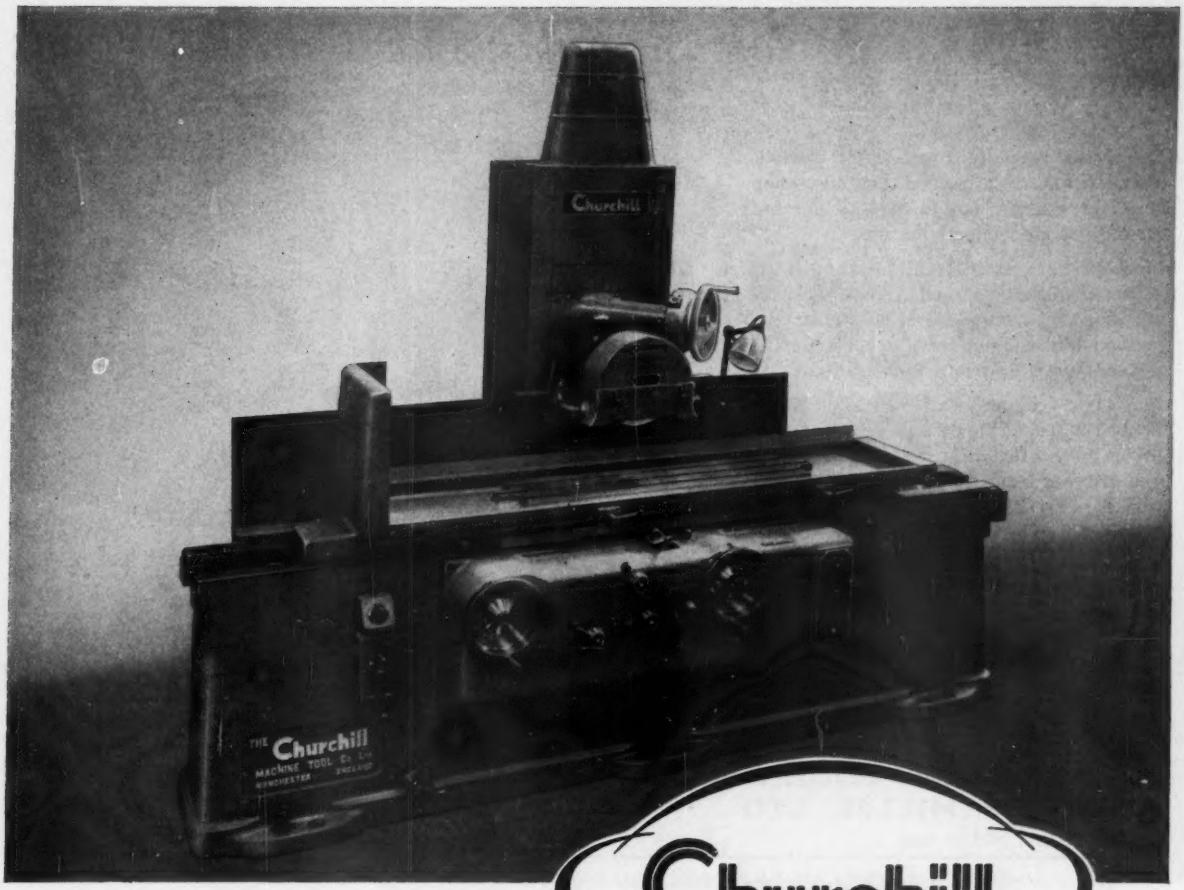


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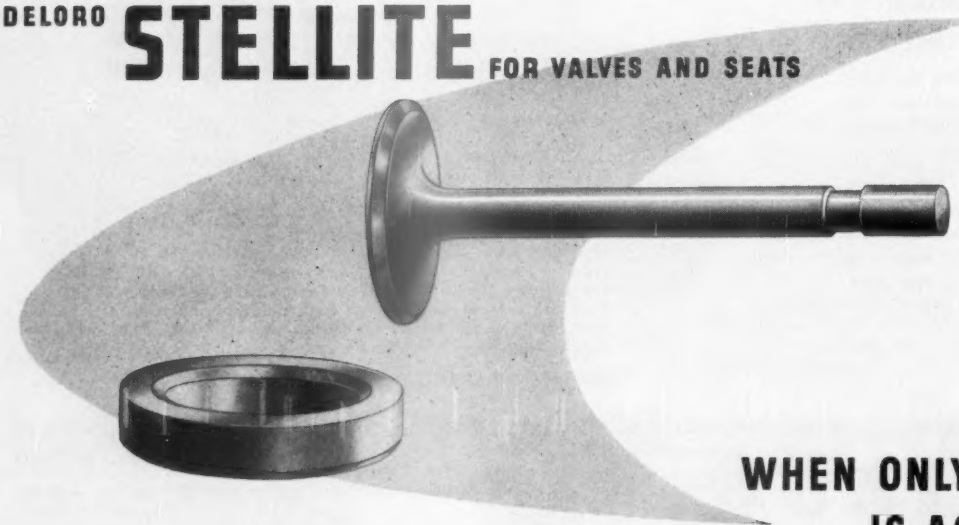

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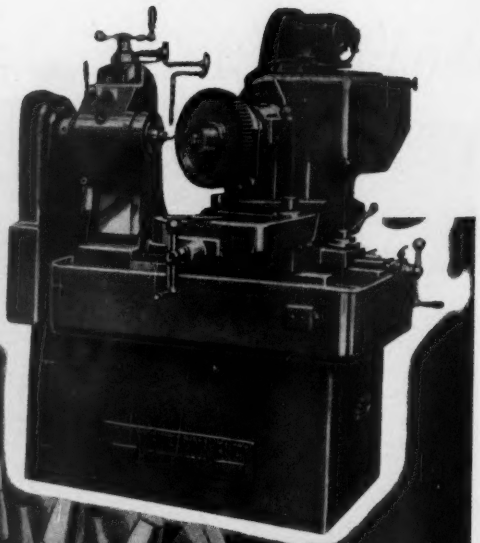

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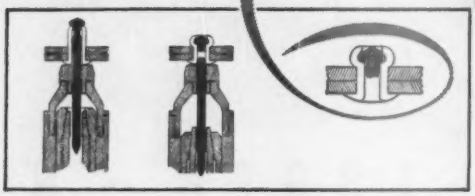

*The illustration above shows "Pop" Rivets being used attaching springs for holding moulding finishers—just one of the many applications in the motor industry.*

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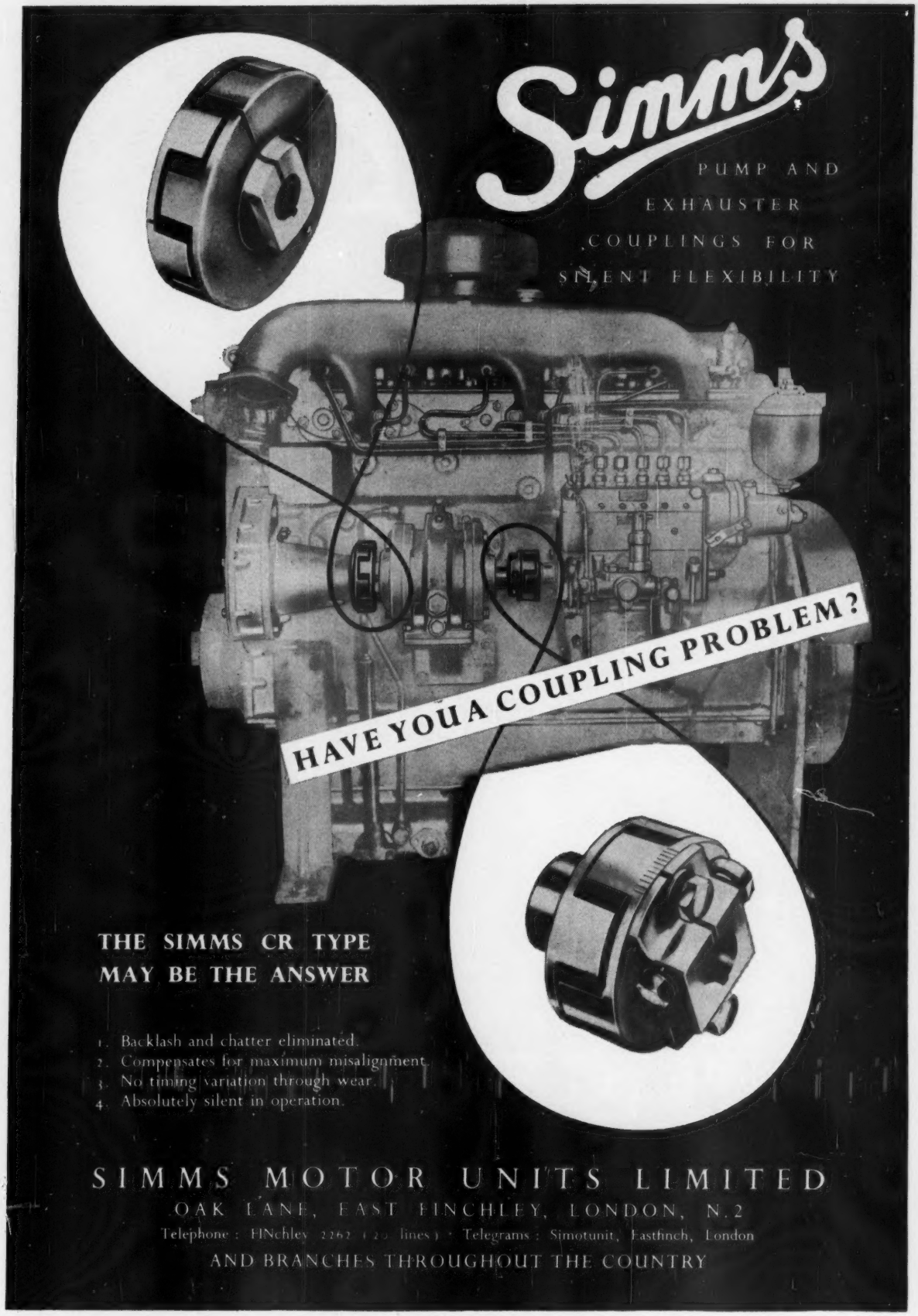
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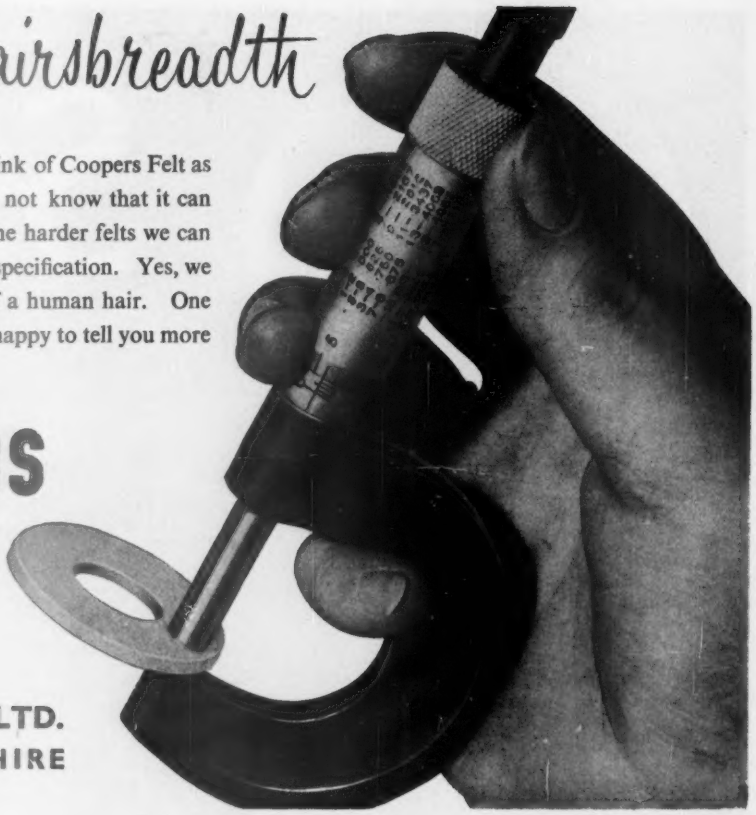

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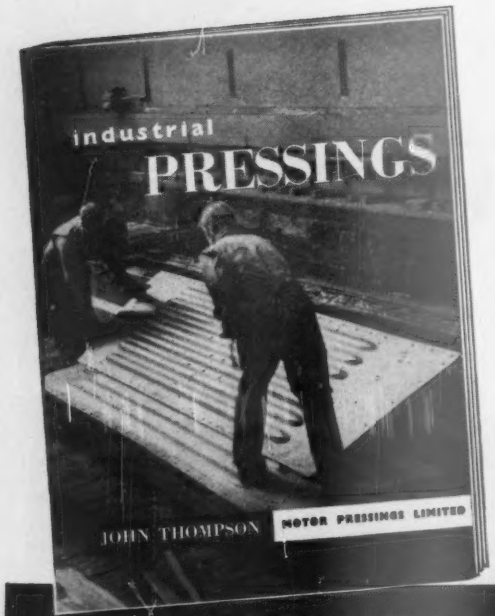


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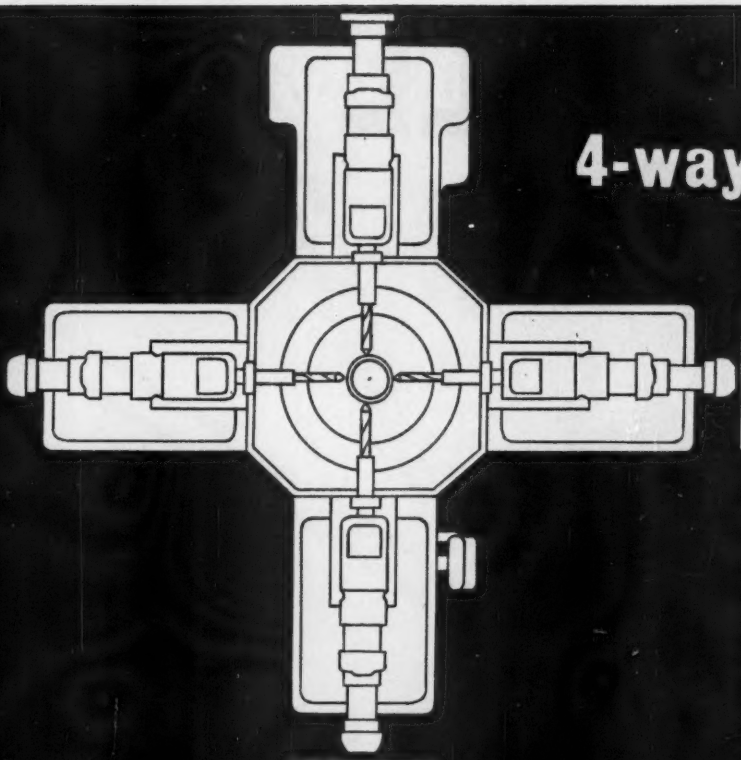

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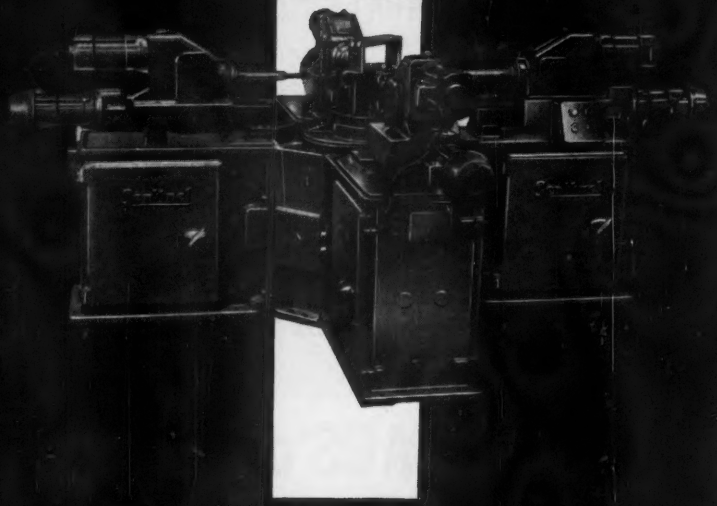

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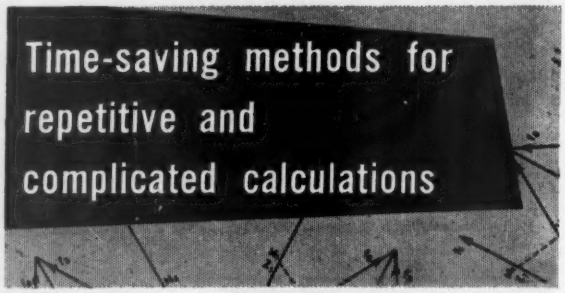


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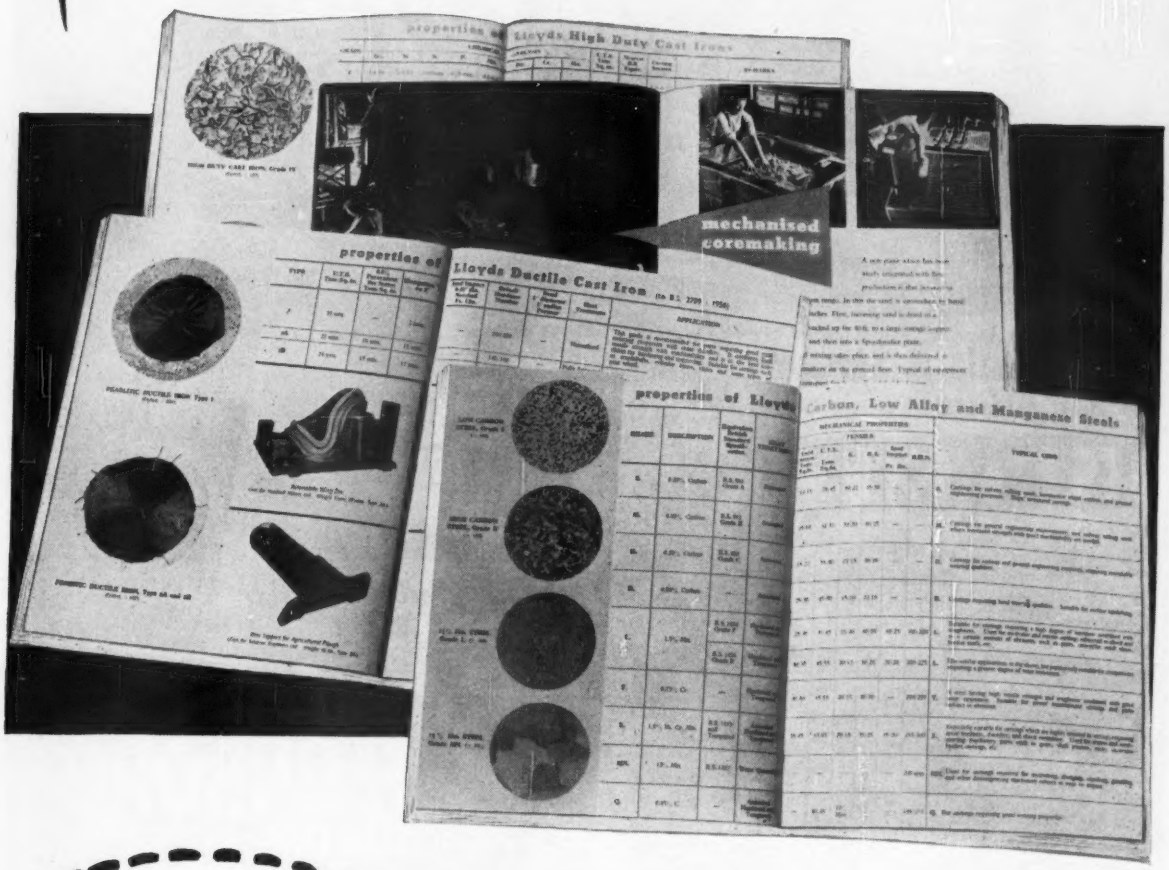
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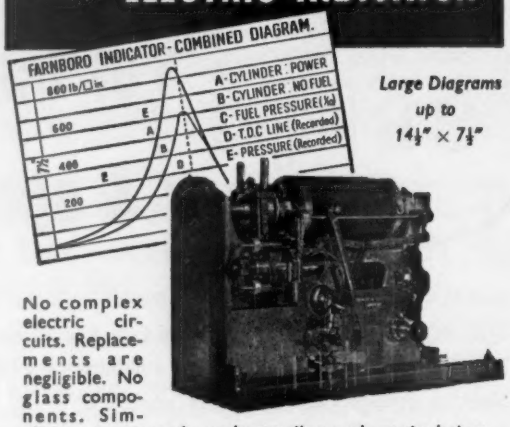


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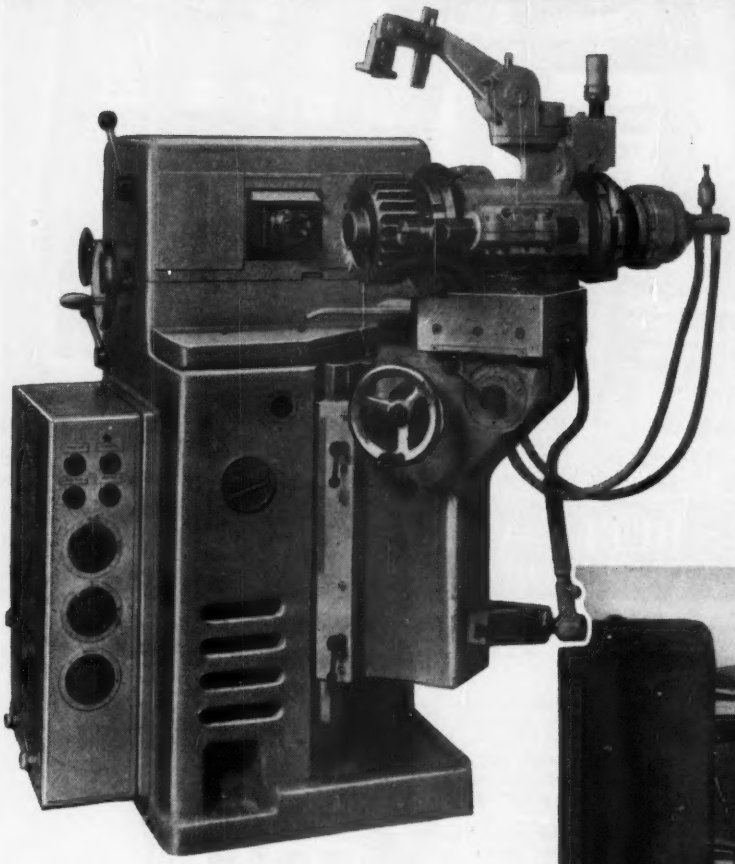

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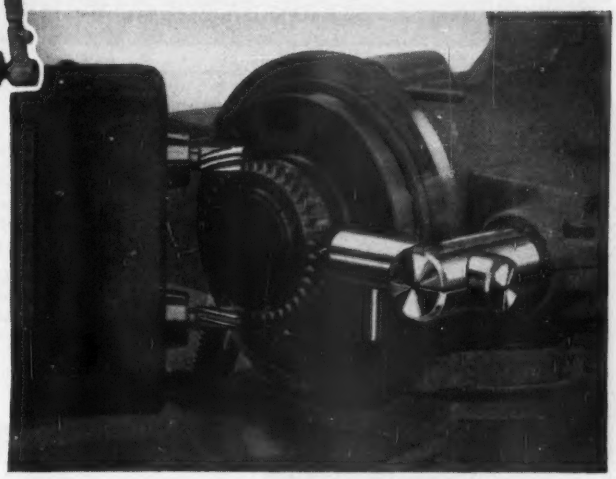

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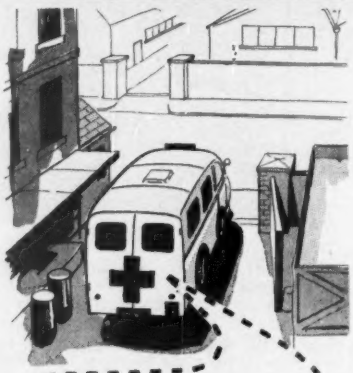

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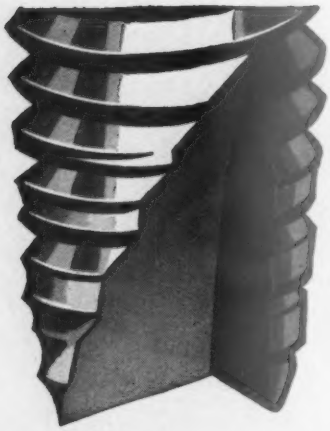

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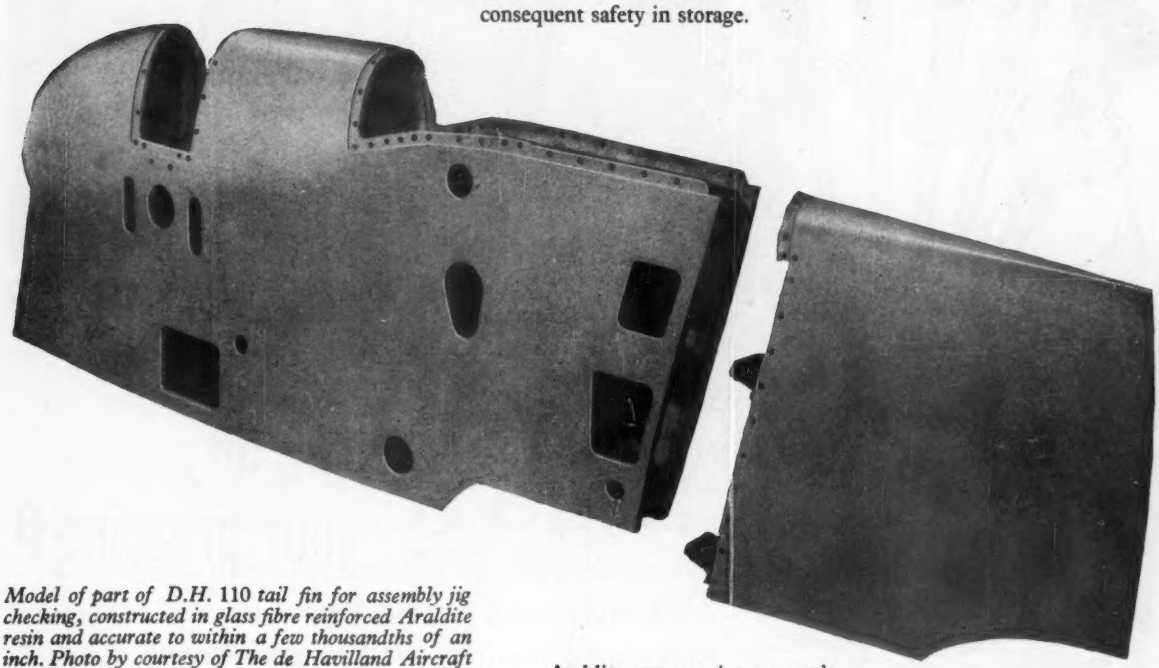

*Model of part of D.H. 110 tail fin for assembly jig checking, constructed in glass fibre reinforced Araldite resin and accurate to within a few thousandths of an inch. Photo by courtesy of The de Havilland Aircraft Co. Ltd.*

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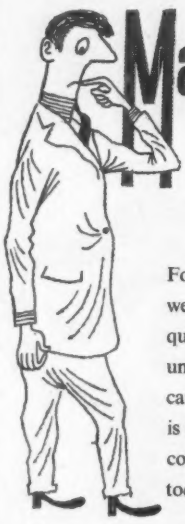

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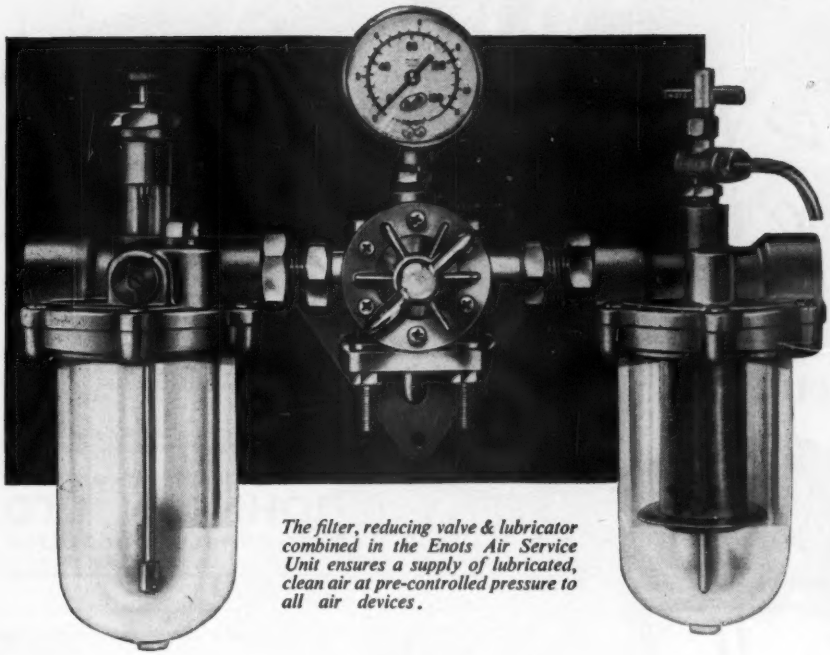

*The filter, reducing valve & lubricator combined in the Enots Air Service Unit ensures a supply of lubricated, clean air at pre-controlled pressure to all air devices.*

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He is in fact, saving as much as 90% in compressed air consumption by using an ENOTS PUFFER VALVE in place of an open ended pipe for the displacement of swarf. A leak in a 100 lb. per sq. inch air line, equivalent to a $\frac{1}{16}$" diameter hole will pass 390 cu. ft. of free air per hour and waste the equivalent of 2 tons of coal per year (2,500 hours operation).

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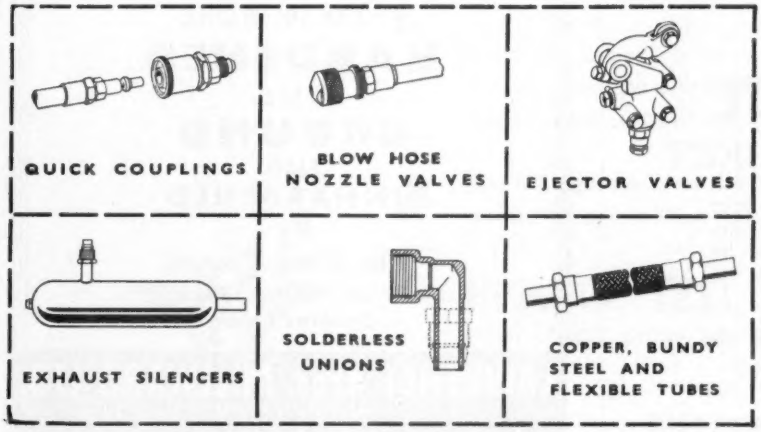


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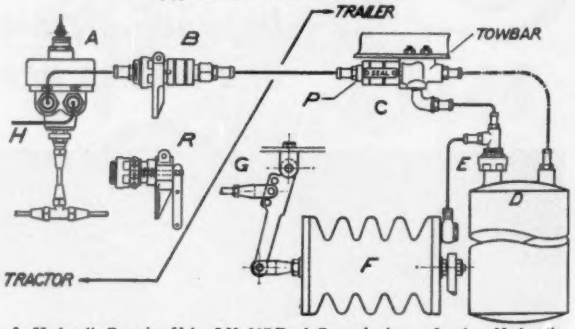


A. Hydraulic Reaction Valve LV. 207 Dual Control, shown fitted to Hydraulic Pipe Line on Tractor.
B. "C" type Coupling with Auto. Shut-off Valve, attached to rear of Tractor.
C. Breakaway Valve SBS. 256 (or SBS. 257) attached to Tow Bar of Trailer.
D. Vacuum Tank on Trailer.
E. Non-return Valve.
F. Power Unit on Trailer operating Brakes.
G. Trailer Brake linkage.
H. Hose connecting LV. 207 to source of Vacuum. Hose connections shown as solid lines are those used in normal operation of Brakes. The Hose shown in broken line connects the Vacuum Tank to the Power Unit when Valve "C" is operated in emergency.
P. Plunger with Safety Seal.
R. This assembly should be used in place of Coupling 'B', when Vacuum Pipe Line operating Trailer Brakes is common to that controlling Brakes on the Tractor.

Existing Trailer can be converted by adding "C", "D" and "E".

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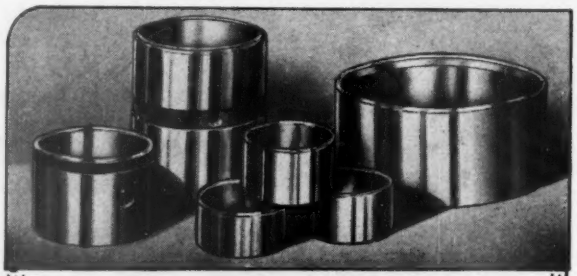

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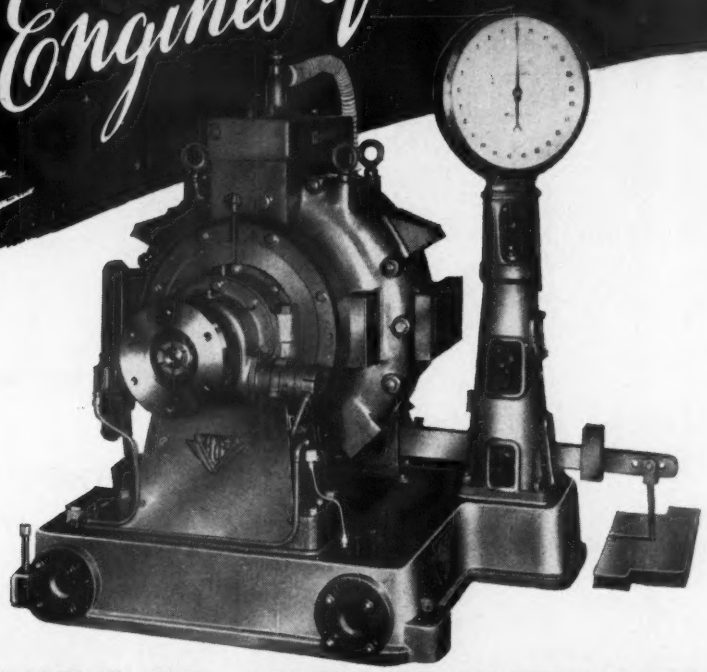

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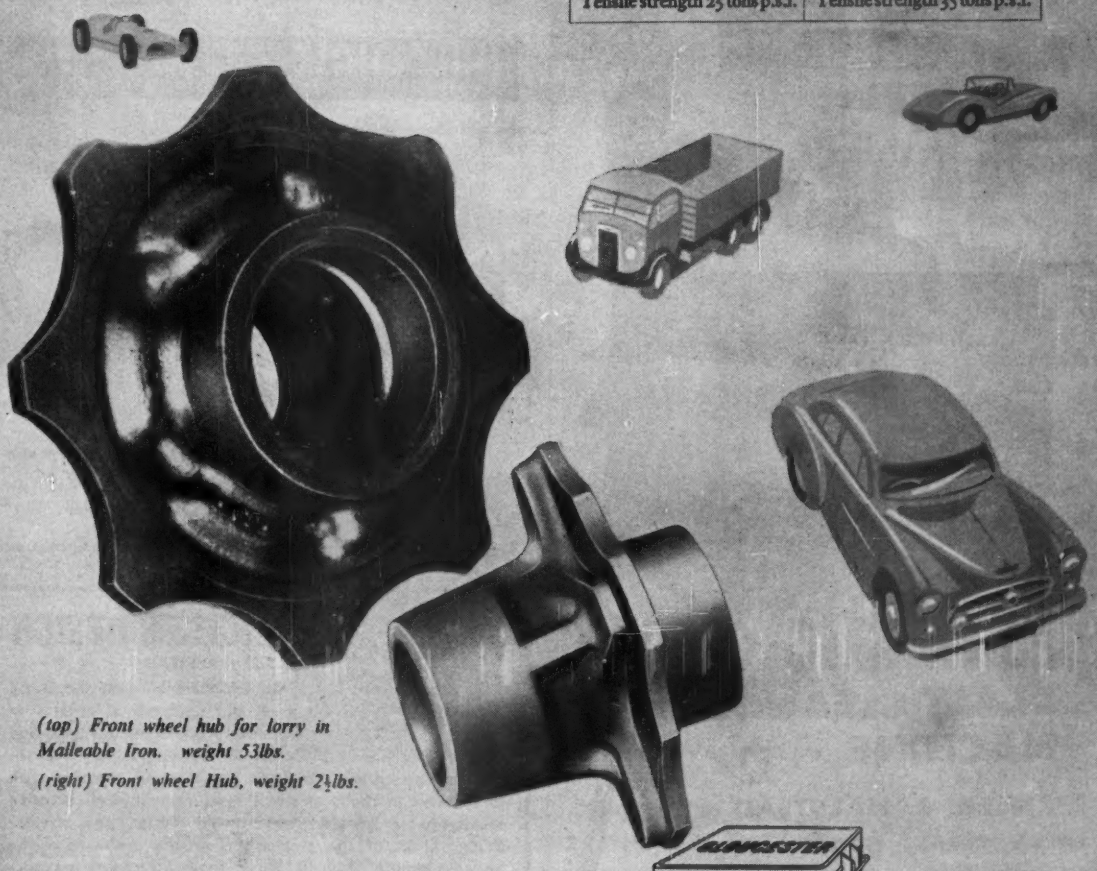

*(top) Front wheel hub for lorry in Malleable Iron. weight 53lbs.*
*(right) Front wheel Hub, weight 2½lbs.*

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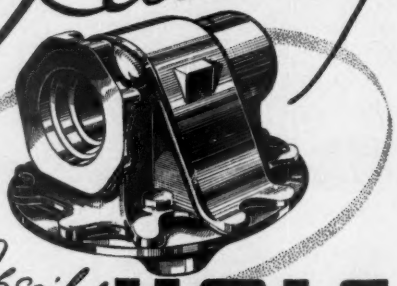

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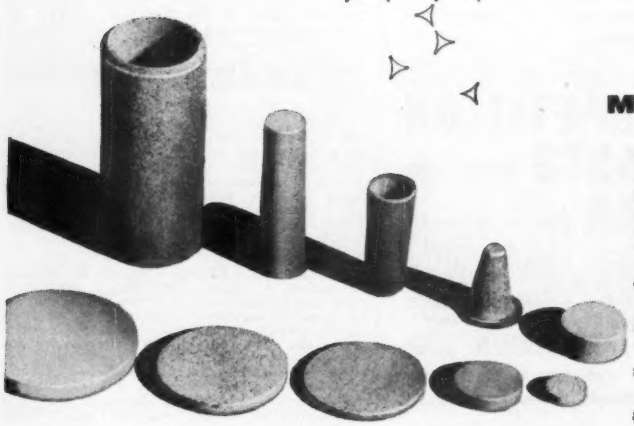

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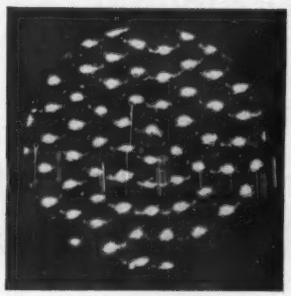

*This microphotograph shows a section of a Bound Brook Filter. Note the porous structure formed by the use of spherical metal powder.*

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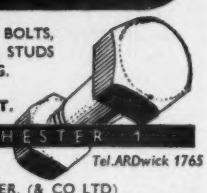

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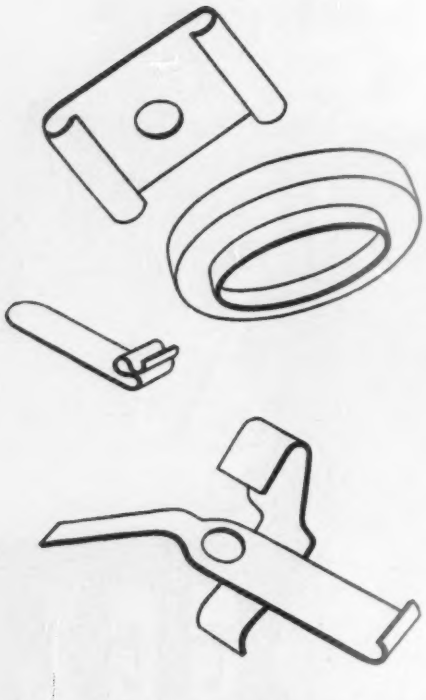

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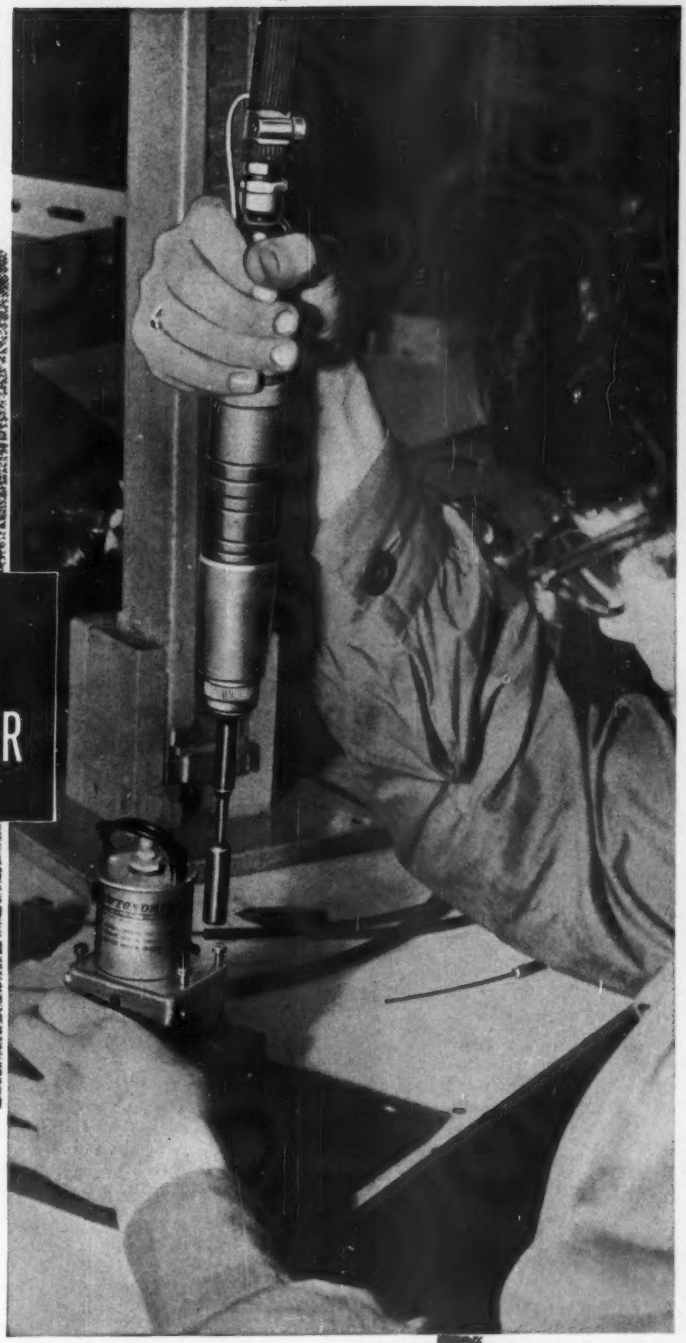

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